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Original Research Article

Analysis of Values of Complete Blood Count and Peripheral Blood Smear Picture in Patients Admitted with Acute Chest Pain to Predict the Risk of Coronary Artery Diseases in a Tertiary Care Hospital

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Abstract:

Introduction: Complete Blood Count (CBC) and Peripheral Smear (PS) study are the basic common blood investigations requested by clinicians and we can diagnose the various clinical conditions like acute or chronic infections, Leukemoid reaction, and leukemia through WBC counts, Anemia sub types and bleeding disorders. Though the bio-markers of inflammation are numerous, the least expensive test of CBC can be used as a risk predictors of cardiovascular diseases (CVD).

Methodology: A prospective cohort study conducted on 60 study participants in whom 40 were taken from cases admitted with chest pain in emergency medical ward and 20 healthy individuals were taken as controls. This study was conducted at Chengalpattu Medical College for the period of 2 months [June 2024 to July 2024].

Results: The WBC count, Neutrophil Count, Lymphocyte Count, Neutrophil Lymphocyte Ratio (N/L), Platelet Lymphocyte Ratio (P/L) showed statistical significance with the p value of < 0.05. Majority of the peripheral smear picture showed Neutrophilia.

Discussion: CBC offers variety of information to suggest the pathogenesis of many diseases. WBC count and Neutrophil lymphocyte ratio (NLR) can reflect systemic inflammation. Our study results showed that there is significant association with the parameters of WBC count, neutrophil count, lymphocyte count, Neutrophil Lymphocyte Ratio and Platelet Lymphocyte Ratio with the CVD risk. The peripheral smear picture also provides supportive evidence of neutrophilia in majority of the cases reflecting strong association with cardiovascular events. Many studies also stated these similar association of certain CBC parameters and CVD risk.

Conclusion: CBC parameters such as elevated WBC count, N/L ratio, P/L ratio and peripheral smear can be considered as predictors as risk for cardiovascular events. However further larger studies are needed to support the potential role of CBC parameters and peripheral smear as these are least expensive and routinely assessed set of investigations for CVD risk in previously healthy populations.

Keywords: Complete blood count (CBC); cardiovascular disease (CVD); Myocardial infarction (MI); Neutrophil lymphocyte ratio (NLR); Platelet lymphocyte ratio (PLR).

Introduction

Complete Blood Count (CBC) and Peripheral Smear (PS) are one of the few basic common blood investigations requested by clinicians and it evaluates the total numbers and characteristics of cell components in the blood, such as White blood cells (WBCs), Red blood cells (RBCs), and Platelets.

Through the CBC and Peripheral smear results, we can diagnose the various conditions including acute or chronic infections, Leukemoid reaction, and leukemia through WBC counts, anemia and its subtypes and bleeding diasthesis. Though the bio markers of inflammation are numerous, the inexpensive test of WBC count has gained attention as a marker of inflammation and several studies have stated that various components of CBC can be used as risk predictors of cardiovascular diseases (CVD), atherosclerosis, arteriosclerosis, Type 2 diabetes (T2DM), and metabolic syndrome.

This has paved way for analysis of the importance of Complete Blood Count and Peripheral Smear in

patients admitted with acute chest pain to predict the risk of cardiovascular diseases. [1]

Review of Literature

Chest pain is the second most common presenting symptom comprising approximately 5% of all emergency department visits and encompasses a broad differential diagnosis that includes several life-threatening causes. The approximate percentage of patients presents with chest pain with life threatening conditions includes Acute coronary syndrome (31%), Pulmonary embolism (2%), Pneumothorax (1%), Pericardial tamponade (Pericarditis 4%), Aortic dissection (1%), Esophageal perforation (1%). (2) Other common causes of chest pain includes Gastroesophageal reflux disease (30%), musculoskeletal causes (28%), Pneumonia/ pleuritis (2%), Herpes zoster (0.5%). [2]

Coronary artery disease (CAD) referred to as Coronary Heart Disease (CHD), results from decreased myocardial perfusion that causes angina pectoris, myocardial infarction (MI), and/or heart failure. It accounts for one-third to one-half of the cases of Cardiovascular Diseases (CVD). [3] Coronary artery disease (CAD) is still the most common cause of deaths in the world, which is preceded by atherosclerosis in the epicardial coronary arteries. The atherosclerotic plaque progressively narrows the coronary artery lumen and impairs antegrade myocardial blood flow. Although atherosclerosis is a multifactorial process, inflammatory and immunological factors are considered to play critical roles. Recently, there have been many studies investigating the role of inflammatory and biochemical markers derived from complete blood count (CBC) in Coronary artery disease. (4) Many studies have compared the parameters of RBC count, Hemoglobin, WBC count, differential count, Neutrophil Lymphocyte ratio (N/L), Platelet/Lymphocyte (P/L) ratio, Platelet Distribution Width (PDW) values, Red blood cell distribution width (RDW) values etc. with myocardial perfusion and found there is significant association between these parameters and Coronary Artery Diseases. [3,4]

Aims & Objectives

- To compare with the control group and analyze the changes in values of Complete Blood Count and Peripheral Blood smear picture in patients admitted with acute chest pain.
- To predict the hematological risk factor and changes in the values of CBC & Peripheral Blood Smear picture in patients admitted with acute chest pain with associated co morbidities.

Methodology

This is a prospective cohort study conducted on 60 patients admitted with chest pain in Emergency Medical Ward at Chengalpattu Medical College, Chengalpattu for the period of 2 months from June 2024 to July 2024. Out of 60 cases, 40 cases were taken as test group with acute chest pain and 20 cases of healthy individuals were taken as control group. Basic laboratory investigations of Complete Blood Count (CBC) and Peripheral Smear (PS) were sent via EDTA Blood collection tubes to Central Laboratory of Chengalpattu Medical College Hospital within 30 minutes of admission. Complete Blood Count (CBC) was done using Automated 3 part Hematology analyzer SYSMEX and Peripheral Smear was done in usual method using Leishman's stain. Peripheral Smear examination was carried out by multiple Pathologists working at Chengalpattu Medical College to get condensed report and both the results were analyzed.

Observation and Results

Among the 60 study participants, 40 patients were taken as test group admitted with chest pain and 20 healthy individuals were taken as control group in our study. The mean age of the study participants was 53 years with male predominance was observed in our study. In our study 9 participants had associated comorbidities of Diabetes and 13 participants had hypertension and 3 participants had associated both Diabetes and hypertension.

In our study, the patients admitted with chest pain was further evaluated through other confirmatory investigations such as ECG findings, elevated Cardiac biomarkers and they were diagnosed as 20 cases of Myocardial infarction and 20 cases of unstable angina. Pearson's chi square tests were established between the study participants age group, co morbidities and diagnosis of cases. There was significant correlation with a P value of < 0.001 was established between Age and co morbidity, whereas the statistical significance was not established between the Diagnosis and co morbidity (Table 1).

In our study, one test group of 40 participants with cardiovascular events and other control group of 20 participants, the CBC parameters of two study groups were evaluated. In the Test group of 40 cases, the RBC count values with the range of 2 to 4 million cells/ cumm was found in 11 cases and 24 cases showed values between 4 to 5 million cells/ cumm; 5 cases showed values between 5 to 5.5 cells/ cumm. The Haemoglobin values showed 1 case of severe anemia with Hb of 4.5g/dl; 3 cases showed Hb values with the range of 8 to 10 g/dl and 20 cases showed Hb values within the range of 10 to 12 g/dl. The Haemoglobin values within the range of 12 to 15 g/dl was found to be 16 cases. The low Haematocrit value of 16.2% was found in

1 case; 16 cases showed Hematocrit values between 30 to 35 %; 14 cases showed Hematocrit values between 35 to 40 %; 8 cased showed Hematocrit values between 40 to 45 %. The RDW was increased in 1 case with the value of 23.6; other 36 cases showed RDW within the range of 12 to 14; Other 3 cases showed RDW within the range of 14 to 16. The MCV, MCH, MCHC were found within normal limits. The low WBC count was found in 1 case; 3 cases showed Total count within normal limits and elevated WBC count within the range of 11000 to 20,000 was observed in 36 cases with the differential count showing increased neutrophils was observed in all 36 cases of Test group. The platelet parameters were found within normal limits in 37 cases; whereas 2 cases showed platelet values less than 1.5 lakhs/cumm and 1 case showed Thrombocytosis. The Neutrophil lymphocyte Ratio were calculated for all the cases, and it was found that 5 cases showed NLR Ratio within normal range (0.7 to 3.5). The increased NLR ratio was observed in 41 cases within the range of > 3.5 to 10. The NLR Ratio of more than 10 was found in 4 cases. The Platelet lymphocyte Ratio were calculated for all the cases, and it was found that 9 cases showed PLR ratio within normal range (90 to 210) and increased PLR ratio within the range of 210 to 400 was observed in 35 cases; 6 cases showed PLR ratio within the range of more than 400. In the control group all the parameters were observed within normal limits. A statistical analysis was established between the both Test and control groups, the mean and standard deviation values are calculated. (Table 2). The CBC parameters were subjected for Levene's test for Equality of Variances and statistical significance was evaluated. The RBC parameters such as RBC Count showed p value of 0.139, Hemoglobin showed p value of 0.235, Hematocrit showed p value of 0.581 and RDW showed p value of 0.30. Hence Statistical significance was not established with all the RBC parameters. The WBC count showed p value of 0.071, Neutrophil count showed p value of 0.051, Lymphocyte count showed p value of 0.230, Platelet count showed p value of 0.418, Neutrophil Lymphocyte ratio showed p value of 0.003 and Platelet Lymphocyte ratio showed p value of 0.001. Hence the CBC Parameters of Neutrophil count, N/L ratio and P/L ratio establishing the statistical significance with the p value of < 0.05. (Table 3). In the Peripheral Smear picture of Test group, out of 40 cases 36 cases showed neutrophilia and leukocytosis, whereas the RBC series and Platelet series showed normal blood picture in our study. The peripheral smear picture of control group showed normal blood picture.

Table 1: Showing association of study participants with age and comorbidities.

		Diagnosis	Comorbidity	Age
Diagnosis	Pearson Correlation	1	.109	-.142
	Sig. (2-tailed)		.406	.278
	N	60	60	60
Comorbidity	Pearson Correlation	.109	1	**-.336****
	Sig. (2-tailed)	.406		.009
	N	60	60	60
Age	Pearson Correlation	-.142	**-.336****	1
	Sig. (2-tailed)	.278	.009	
	N	60	60	60
**. Correlation is significant at the 0.01 level (2-tailed).				

There is a significant correlation between age and comorbidity

Table2: Showing Mean and Standard deviation for both cases and control groups. Group 1---Control; Group 2----Cardiac Events

	DCODE	N	Mean	Std. Deviation
Hemoglobin	1.00	20	12.520	.7804
	2.00	40	12.060	1.6993
Rbc Count	1.00	20	4.1490	.37141
	2.00	40	4.2430	.57225
Hematocrit	1.00	20	36.850	3.3196
	2.00	40	35.692	4.7107
Red Cell Distribution Width	1.00	20	13.375	.7953
	2.00	40	13.500	1.8624
Wbc Count	1.00	20	8175.000	1960.9007
	2.00	40	13700.000	4156.7369
Neutrophil	1.00	20	62.300	6.2078
	2.00	40	71.625	12.8216

Lymphocyte	1.00	20	26.350	6.8769
	2.00	40	19.013	12.0870
Platelet Count	1.00	20	4.2100	.65365
	2.00	40	3.2890	1.79087
Neutrophil Lymphocyte Ratio	1.00	20	2.6045	1.09850
	2.00	40	5.5900	4.55338
Platelet Lymphocyte Ratio	1.00	20	171.350	54.3887
	2.00	40	241.925	129.3830

Table 3: Showing Levene's Test for Equality of Variances

Independent Samples Test		
Levene's Test for Equality of Variances		
Variables	F	Sig. (2-tailed)
Hemoglobin	1.440	.235
RBC Count	2.251	.139
Hematocrit	.307	.581
Red Cell Distribution Width	1.096	.300
WBC Count	3.382	.071
Neutrophil	3.981	.051
Lymphocyte	1.469	.230
Platelet Count	.665	.418
Neutrophil Lymphocyte Ratio	9.660	**.003**
Platelet Lymphocyte Ratio	11.760	**.001**

Discussion

CBC offers a variety of information by reflecting the pathogenesis of the diseases. WBC count and Neutrophil Lymphocyte ratio (NLR) can reflect systemic inflammation. Platelets can reflect vascular damage and systemic inflammation and provide disease severity and gender differences. These markers can be obtained directly from CBC results or can be obtained through simple calculations. CBC's are cost-effective, and they are routinely performed in most clinical settings. In our study, we evaluated the relationship between CBC parameters such as RBC count, Hemoglobin, Hematocrit, RDW, WBC count, Neutrophil count, Lymphocyte count, Neutrophil Lymphocyte ratio and Platelet Lymphocyte ratio with cardiovascular events.[5]

Our study results showed that there is significant association was established over the parameters of WBC count, Neutrophil count, Lymphocyte count, Neutrophil Lymphocyte ratio and Platelet Lymphocyte ratio with p value < 0.05. The peripheral smear picture also shows Neutrophilia in majority of the cases with normal RBC and Platelet series which also provides supportive evidence that elevated WBC count especially Neutrophilia has a strong association with cardiovascular events.

Arsalan Majeed et al (2018) has stated that blood count indices such as neutrophil count, RDW, MPV, high NLR and high PLR have been reported as effective predictors of cardiovascular morbidity and mortality, except RDW and MPV other findings were concordant with our study.[6]

Camille et al (2018) has stated that increased total WBC, lymphocyte, monocyte and neutrophil counts were associated with higher risk of incident CVD and RBC count and hematocrit showed no clear association which is concordant with our study.[7]

In-Ho Seo et al (2022) has stated that CBC components including WBC, NLR, RDW, and MCV could improve the sensitivity and specificity of detecting and predicting cardiovascular diseases, except RDW and MCV all other findings were similar to our study. Semra Ozdemir et al (2015) has stated that the Outcome of his study showed Neutrophil lymphocyte ratio (N/L) is significantly increased in patients with myocardial ischaemia which supported our study.[8]

Julio Núñez et al(2005) has stated that WBC determined in the first few hours of AMI is a predictor of long-term mortality in the early risk stratification of Myocardial infarction, which stressed the need for routine CBC. Hal V. Barron et al (2000) has observed that elevations in WBC count on admission are associated with higher incidence of Congestive heart failure (CHF), which is a valuable measure for Coronary Heart disease.[9]

Temiz et al. showed that elevated Platelet lymphocyte ratio is an independent predictor factor of cardiovascular mortality and in our study also elevated P/L ratio has significant association with cardiovascular events.[12]

Mohammad Madjid et al (2013) has stated that Elevated levels of almost all subtypes of WBCs, including eosinophils, monocytes, neutrophils and lymphocytes have been associated with increased risk of CHD, whereas only neutrophils and lymphocytes were elevated in our study. They also stated that high platelet counts, increased mean platelet volume and a rapid platelet-aggregation response are associated with increased long-term coronary death whereas these findings are not observed in our study, as ours is a pilot study for shorter duration.[18]

Summary

- Among the 60 study participants, 40 patients were taken as test group admitted with chest pain and 20 healthy individuals were taken as control group in our study.
- The mean age of the study participants was 53 years with male predominance was observed in our study.
- Pearson's chi square tests done between the study participants age group, comorbidities and diagnosis of cases and there is a significant correlation with a P value of < 0.001 was established between age and comorbidity.
- Among the CBC parameters, in cases of chest pain patients, which were subjected for Statistical analysis no significant correlation was established between the RBC parameters and Chest pain.
- The Neutrophil count, Neutrophil Lymphocyte ratio, Platelet Lymphocyte ratio showed statistically significant value with the p value of < 0.05.
- Several other studies also stated that the elevated WBC count, N/L Ratio, P/L Ratio were associated with cardiovascular risks which are supportive evidence for our study.
- The peripheral smear picture also shows neutrophilia in majority of the cases with normal RBC and Platelet series which values an evidence for elevated WBC count especially Neutrophilia has a strong association with cardiovascular events.

Conclusion

CBC and Peripheral smear examination is basic investigation of choice to identify the cause of the many illnesses and in spite of being the simple inexpensive and widely available tests, some of the CBC parameters such as elevated WBC count, N/L ratio, P/L ratio and peripheral smear can be considered as predictors of the risk of cardiovascular events. However further larger studies are needed to support the potential role of CBC parameters and peripheral smear as an inexpensive and routinely assessed set of investigations for CVD risk in previously healthy populations.

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