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Hematological Parameters for Predicting Coronary Artery Disease Severity

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Abstract

Background: Inflammation plays the key role in pathogenesis of coronary artery disease. Various studies in literature has shown relation between various hematological parameters and coronary artery disease. But relation between these hematological parameters and severity of coronary artery disease is less studied. *Aim:* To know relation between various hematological parameters and severity of coronary artery disease. *Method:* We enrolled a total of 101 patients with ST elevation myocardial infarction who underwent coronary angiography. In control group, 31 patients were taken with normal coronary angiogram. White blood count, Neutrophil %, Lymphocyte %, Neutrophil/lymphocyte ratio, Platelet count, Red cell distribution width, Mean platelet volume, Platelet distribution width, Large platelet concentration ratio, HBA1c and Troponin I were taken. Coronary artery disease severity is assessed by SYNTAX score. *Results:* Age distribution was similar between cases and control (p = 0.921). Males were predominant among both cases and control. Patients with coronary artery disease had higher white blood cell count, neutrophil count, neutrophil/lymphocytic ratio, red cell distribution width, mean platelet volume, platelet distribution width, large platelet concentration ratio. A very weak correlation was found between syntax score and white blood cell count, neutrophil-lymphocyte ratio, red cell distribution width, mean platelet volume, platelet distribution width and large platelet concentration ratio which is statistically insignificant too. But a significant correlation was found between SYNTAX score and glycosylated hemoglobin and troponin I levels in acute coronary syndrome. *Conclusion:* Hematological parameters does not have good correlation with syntax score except Troponin I and HBA1c, for predicting coronary artery disease severity.

Keywords: Coronary artery ectasia; Coronary artery disease; Diabetes; Hypertension and obesity.

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Introduction

Coronary artery disease is a major cause of death worldwide. It is the inflammation which is considered to play the key role in pathogenesis of plaque formation and its rupture leading to acute coronary syndrome. This inflammation leading to acute coronary syndrome release various biomarkers in blood stream which have various diagnostic and prognostic values. The role of red blood cells, platelets and WBC indices are recently studied in various studies. But the correlation of these indices with coronary artery disease severity is studied in very few studies. Coronary artery disease severity is assessed by various scoring methods, but we used syntax score in this study.

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We assessed the correlation of various hematological parameters with coronary artery disease severity in present study.

Materials and Methods

This study is a retrospective observational cohort study. It included 101 cases with coronary artery disease presented as acute coronary syndrome and 31 controls with normal coronary angiogram who were admitted in Sri Jayadeva Institute of Cardiovascular Science and Research, Mysore for coronary angiogram between January 2016 to April 2016.

Inclusion Criteria

All patients with STEMI (less than 5 day's duration)

Exclusion Criteria

Patients with sepsis, autoimmune disorders, heart failure, renal or hepatic failure, steroid users and malignancy.

Hematological parameters were analyzed from blood samples taken during hospitalization. Parameters were hemoglobin, red blood cell count, red cell distribution width, white blood cell count, neutrophil count, lymphocyte count, neutrophil/ lymphocyte ratio, platelet count, Mean platelet volume, platelet distribution width and large platelet concentration ratio. Also, HBA1c, troponin I and ejection fraction on echocardiography was taken.

Coronary artery disease severity - Coronary angiography was done using seldinger technique. All angiography was interpreted by two researchers. At least ≥ 50% stenosis of coronary artery is considered to be significant coronary artery disease. Although there are various scores available for assessing coronary artery disease severity like, SYNTAX score, GENSINI score, TIMI Score etc. But in present study, syntax score was calculated using syntax score calculator through www.syntaxscore.com.

An informed consent has been taken from all patients enrolled in our study and this study has been approved by our local ethics committee.

Statistical Analysis

Data was analyzed using SPSS (Statistical Package for Social Sciences) 20.0 version, IBM, Chicago. The data was analyzed for probability distribution. On employing the Kolmogorov Smirnov test, the p - value < 0.05 indicated that the data was not normally distributed and thus nonparametric test of significance were employed. The between group comparisons were done using Man Whitney *U* test. The correlation between the different variable was assessed using Spearman's correlation coefficient. Independent predictor was analyzed using Logistic regression analysis.

Results

The study population consisted 101 cases with coronary artery disease and 31 cases with normal coronary angiogram. The baseline characteristics are shown in Table 1. Age and sex distribution was similar between cases and control (p = 0.921). Males were predominant among both cases and control. Patients with coronary artery disease had higher white blood cell count (12794.1 ± 4746.8 *vs* 8861.3 ± 3640.9, p < 0.001), neutrophil count (74.2 ± 11.3 *vs* 65 ± 7.7, p < 0.001), neutrophil/lymphocytic ratio (4.96 ± 2.67 *vs* 2.46 ± 0.83, p < 0.001), red cell distribution width (16.1 ± 1.5 *vs* 14.7 ± 1.6, p < 0.001), mean platelet volume (7.6 ± 0.7 *vs* 7.1 ± 0.8, p = 0.002), platelet distribution width (11.6 ± 0.9 *vs* 10.97 ± 0.9, p < 0.001), large platelet concentration ratio (12.4 ± 3.6 *vs* 9.5 ± 2.9, p < 0.001).

Table 1: Baseline characteristics of cases and control

Parameters	Cases (n = 101)	Control (n = 31)	p - value
Age (years)	52.8 ± 11	52.7 ± 7.9	0.921
Male sex	84	21	0.063
Smoking		10	0.626
Alcohol	26	8	0.994
Diabetes	18	8	0.328
Hypertension	24	9	0.553
Dyslipidemia	101	6	0.000
Aspirin Users	100	4	0.000
Clopidogrel Users	96	1	0.000
Statin Users	101	11	0.002

Parameters	Cases (n = 101)	Control (n = 31)	p - value
ACE inhibitor Users	46	11	0.323
ARB users	28	4	0.092
Betablocker Users	61	14	0.134
Diuretic Users	24	2	0.034
Pulse (per min)	81.4 ±14.6	73.7 ± 9	0.002
Mean blood pressure (mm Hg)	95.4 ±15	95.8 ±10	0.581
Hemoglobin (gm/dl)	13.6±2	12.4±2	0.016
Red blood cell count (millions/cumm)	4.5 ± 0.6	4 ± 0.6	< 0.001
White blood cell count (cells/cumm)	12794 ± 4747	8861 ± 3641	< 0.001
Neutrophil count (%)	74±11	65±7.7	< 0.001
Lymphocyte (%)	19.5 ± 9.7	28.6 ± 7	< 0.001
Neutrophil/lymphocyte ratio	4.96 ± 2.7	2.5 ± 0.8	< 0.001
Platelets (lakh/cumm)	2.5 ± 0.6	2.4 ± 0.7	0.106
Red cell distribution width (%)	16.1 ± 1.5	14.7 ± 1.6	<0.001
Mean platelet volume (femtoliter)	7.6 ± 0.7	7.1 ± 0.8	0.002
Platelet distribution width (%)	11.6 ± 0.9	10.97 ± 0.9	< 0.001
Large Platelet concentration ratio (%)	12.4 ± 3.6	9.5 ± 2.9	< 0.001
HBA1c (%)	6.7 ± 1.9	6.3 ± 1.7	0.094
Troponin I (mg/dl)	0.7 ± 0.9	0.1± 0.2	< 0.001
Ejection fraction (%)	45.5941 ± 6.51334	58.3226 ± 6.14485	< 0.001
Syntax score	8.9356 ± 7.39448	NA	< 0.001

Table 2: Correlation between Syntax Score and various parameters amongst the patients of case group

Parameters	Syntax Score	
	Spearman correlation coefficient	p - value
Age (years)	0.424	0.000*
Pulse (per min)	-0.072	0.471
Blood pressure (mm Hg)	-0.057	0.569
Hemoglobin concentration (gm/dl)	-0.160	0.110
Red blood cell count (millions/cubic mm)	-0.154	0.124
White blood cell count (cells/cubic mm)	0.011	0.914
Neutrophil count (%)	-0.059	0.555
Lymphocyte (%)	0.081	0.421
Neutrophil/lymphocyte ratio	-0.080	0.429
Platelets (lakh/cubic mm)	-0.054	0.591
Red cell distribution width (%)	-0.174	0.082
Mean platelet volume (femtoliter)	0.003	0.976
Platelet distribution width (%)	0.066	0.514
Large Platelet concentration ratio (%)	0.032	0.753
HBA1c (%)	0.262	0.008*
Troponin I (mg/dl)	0.335	0.001*
Ejection fraction (%)	-0.464	0.000*

*p – value < 0.05 was considered statistically significant.

A weak correlation was found between syntax score and white blood cell count (r = 0.011, p = 0.914), mean platelet volume (r = 0.003, p = 0.976), platelet distribution width (r = 0.066, p = 0.514), large platelet concentration ratio (r = 0.032, p = 0.753) while a good correlation was present with glycosylated hemoglobin (r = 0.262, p = 0.008) and troponin I (r = 0.335, p = 0.001) as shown in Table 2.

Discussion

In acute coronary syndromes, inflammation, both local and systemic, plays central role in its pathogenesis. During this inflammatory process, various hematological parameters release into blood stream, which can be easily measured and are widely availaible. In present study, we studied the relation of various hematological parameters and coronary artery disease severity. Coronary artery disease severity is measured by various scores like, SYNTAX score, TIMI score, GENSINI score etc. We have chosen SYNTAX score for assessing coronary artery disease severity[1] High White blood cells count is found to be associated with increased cardiovascular mortality in acute coronary syndromes. While, lymphocytes could limit inflammation.[2,3] Lower the lymphocyte count, higher the atherosclerosis progression and adverse clinical outcomes in heart failure and ACS patients.[4] In few studies, platelet indices has also been studied and was found to be associated with coronary artery disease severity.[5] In atherosclerosis,

platelets are involved with chemotactic proteins, growth factors and inflammatory and mitogenic factors. More severe CAD cause the increasing generation of larger platelets with higher MPV from bone marrow. And the large and high amounts of platelets may form atherosclerotic plaques and may lead to the progression of atherosclerosis.[6] In a study by Altun et al., N/L ratio and high sensitive troponin T were significantly correlated with angiographic severity of ACS as assessed by SYNTAX score. But in our study, N/L ratio is found to be negatively correlated with coronary artery disease severity. But Trop I and HBA1c was significantly correlated with coronary artery disease severity. A possible hypothesis is being nonspecific nature of hematological markers like white blood cell count, N/L ratio, red cell distribution width, mean platelet volume, platelet distribution width, large platelet concentration ratio unlike Troponin I.

In our study, we found conflicting results as compared to other studies. We found very weak correlation between syntax score and white blood cell count, mean platelet volume, platelet distribution width, large platelet concentration ratio and is statistically insignificant. But a significant correlation was found between Troponin I, HBA1c and SYNTAX score.

Limitations

It was a single center study and various other inflammatory markers should be measured in controls which may have confounding results. Also, further large studies are required to validate these results.

Conclusion

RBC, WBC and platelet indices are not good predictors for assessing coronary artery disease severity unlike Troponin I and HBA1c.

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