

Association of Red Cell Distribution Width and Role of Cardiac Markers in Acute Non-ST Elevated Myocardial Infarction

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ABSTRACT

Objectives: To investigate the relationship between the red blood cell distribution width (RDW) and acute non-ST elevation myocardial infarction (NSTEMI).

Study Design: Observational descriptive study

Place and Duration: Pathology and Cardiology departments of Peoples University of Medical and Health Science (PUMHS), Nawabshah, from January to December 2015.

Material and Methods: We selected 151 diagnosed patients with non-ST segment elevated acute myocardial infarction, having ages ranged between 43 and 71 years, including 91 males and 60 females admitted in cardiology department of PUMHS, on the basis of clinical history, physical examination, electro cardiogram and echo cardiographic findings. From all these patients, blood samples were collected for complete blood count, Trop t test, cardiac enzymes, blood glucose and low density lipoprotein. All the findings were recorded on a proforma designed for the study and results were statistically analyzed and tabulated.

Results: The mean age was 57±14 and male to female ratio was 1.5:1. These patients were diagnosed with NSTEMI by positive trop-T test, ischemic ECG changes and echocardiography findings. Clinical findings in these were chest pain, dyspnea, fatigueness and ECG findings were showing ST depression with T-wave inversion while echocardiographic findings were showing partial thickness of cardiac muscle or NSTEMI or sub endocardial myocardial infarction. The mean value of hemoglobin was 11.5 g/dl ± 1.5, total leucocyte count were 12200/cumm ± 1200, Neutrophils 80 % ± 5, Lymphocytes 15 % ± 5, Neutrophils /Lymphocytes ratio 5.3 ± 1.1 were founded in this study. The Red cell Distributions Width percentage (with reference range of 14%) was 16.2±2.5 that were significantly correlated with above findings among the patient with non-ST elevated acute myocardial infarction.

Conclusion: Higher red cell distribution width value was associated with high total leucocyte count, parentage of neutrophils, neutrophils lymphocyte ratio in patients with Non-ST elevation acute myocardial infarction.

Key Words: Red Blood Cell distribution width (RDW), Cardiac markers, Non-ST elevated acute myocardial infarction (NSTEMI), coronary artery diseases (CAD)

INTRODUCTION:

The coronary artery diseases CAD include unstable angina, myocardial infarction and heart

failure are caused by the narrowing of the blood vessel due to the atherosclerosis leading to impaired blood and oxygen supply to the heart, the pathophysiological mechanism of atherosclerosis is inflammation supported by finding of C-reactive protein, interleukine-6 and tumor necrosis factor in blood¹. The risk factor for CAD are hypertension, diabetes, family history, genetic disorders, smoking, obesity, alcohol consumption, high fatty diet, lake of exercise and vitamin D deficiency². The myocardial infarction is necrosis of the cardiac muscle cells divided in to five types, type 1 is characterized by instability of atheromatous plaque of coronary artery, type 1 occur due to

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the increased demand or reduce oxygen supply to the myocardium while type 3,4 and 5 are associated with cardiac failure and intra coronary thrombosis and required recent, advanced diagnosis and treatment by laboratory test, angioplasty, percutaneous intervention's and coronary artery bypass grafting (CABG) surgery³. The association between the RDW and CAD and other cardiovascular events caused by inflammation and high oxidative stress that leading to anisocytosis due to the release of immature red blood cells from the bone marrow into the peripheral circulation and reduction in red blood cell survival among the patients with acute myocardial infarction^{4,5}. In the present study, our aim was to investigate the relationship between the RDW and NSTEMI-AMI, and associated cardiac markers, which will be helpful in better evaluation of diagnosis, prognosis and management of acute myocardial infarction.

MATERIAL AND METHODS:

This study was conducted at pathology and cardiology departments of PUMHS, Nawabshah, from January to December 2015. A total of 151 patients were selected for the study, which were admitted in cardiology department of PUMHS having diagnosis of NSTEMI-AMI, on the basis of trop-T test, ECG findings, cardiac enzymes and echocardiography. Demographic characteristics; medical histories, clinical examination, laboratory studies, including white blood cell (WBC) counts peripheral differential counts, and hospital outcomes data were collected. Clinical information was obtained regarding the patients' history of systemic hypertension (HTN); diabetes mellitus (DM); dyslipidemia; smoking; and previous CAD, including coronary angioplasty or myocardial revascularization and a family history of CAD.

Patient with history of trauma, surgery, neoplasm, or infections disease in the last 30 days prior to hospitalization, as well as those currently using immunosuppressant's (including corticosteroids) and patient on aspirin therapy were excluded from this study.

Venous blood was collected in a tube containing K3 EDTA for baseline determination of

trop-T levels in all patients and also for measurement of hematologic indices by using Nihankhoden Hematology Analyzer. All the findings were recorded on a proforma designed for the study and results were statistically analyzed and tabulated.

RESULTS:

A total of 151 patients with their mean age 57 ± 14 and male to female ratio of 1.5:1 were included in this study. These patients were diagnosed with NSTEMI-AMI by positive trop-T test, ischemic ECG changes and echocardiography findings. Majority of the patient were hypertensive, diabetic, obese, smokers, habitual taking of fatty diet, residents of the urban areas, having family history of heart disease and belonging to the lower middle class family. Clinical findings in these were chest pain, dyspnea, fatigueness and ECG findings were showing ST depression with T-wave inversion while echo cardio Graphic Findings were showing partial thickness of cardiac muscle or NSTEMI-AMI or sub endocardial myocardial infarction. The mean value of hemoglobin g/dl 11.5 ± 1.5 , total leucocyte count/cumm 12200 ± 1200 , Neutrophils $80 \% \pm 5$, Lymphocytes $15 \% \pm 5$, Neutrophils /Lymphocytes ratio 5.3 ± 1.1 were founded in this study. The Red cell Distributions Width percentage (with reference range of 14%) was 16.2 ± 2.5 that were significantly correlated with above findings among the patient with non-ST elevated acute myocardial infarction.

DISCUSSION:

The different laboratory research workers reported the association of red cell distribution width (RDW) and laboratory parameters including cardiac markers prompt to diagnosis and management of acute myocardial infarction, hence patients with NSTEMI-AMI present with central chest pain associated with sweating, dyspnea and fatigue while diagnostic criteria of acute myocardial infarction depends on increased Cardiac troponin I level, ECG and echocardiography findings and estimation of cardiac biomarkers required for early diagnosis^{3,4} reported

Table 1. Age, Sex and Risk Factors Among the Patients with Acute Myocardial Infarction (n=151)

Age	Sex	Male to Female Ratio
57±14	Male 91 Female 60	1.5:1
Risk Factors	No of patients	Percentage
Family history	85	56.2
Diabetes mellitus	81	53.6
Hypertension	79	52.3
Smoking	110	72.8
Fatty diet	65	43.0
Obesity	74	49.0
Socio economic status	Upper and lower middle class	Poor
	88	63
Area of residence	Urban	Rural
	81	70

Table 2. Clinical Findings and Laboratory Parameters Among the Patients with Non-ST Elevated Acute Myocardial Infarction (n=151)

Clinical Findings	Laboratories Paramaters
<p>History of Chest Pain, Dyspnea, Fatigueness, nausea, vomiting and sweating</p> <p>Blood pressure: systolic 160 ± 30 mm of hg diastolic 110 ± 20 mm of hg</p> <p>ECG Findings: The changes are ST depression with T-wave inversion</p> <p>Echo cardiographic Findings The partial thickness of cardiac muscle seen in NSTEMI or sub endocardial myocardial infarction.</p>	<p>Hematological parameters Hemoglobin g/dl 11.5 ± 1.5 Total leucocyte Count/cumm 9500 ± 3500 Differential leucocyte Count Neutrophils 80 % ± 5 Lymphocytes 15 % ± 5 Neutrophils /Lymphocytes ratio 5.3 ± 1.1 Platelates Count /cumm 250,000 ± 60,000 Red cell Distributions Width % (cut of value 13.5) 15.8±3.2 % Trop-T Test +ve in all cases Creatinine kinase -MB 155 ± 30 IU/l Total Cholesterol Level 90 ± 20 mg/dl Low Density Lipoprotein C level 135 ± 10 mg / dl Blood glucose fasting 90 ± 20 mg/dl random 190 ± 40 mg/dl</p>

Laboratory parameters	RDW > 14.05 %	RDW < 14.05%
Low density lipoprotein c mg/dl	125±10mg/dl	80±10mg/dl
Total leucocytes count /cumm	11800±500/cumm	9600±100/cumm
Percentage of neutrophils	85±5	70±2
Percentage of lymphocyte	20±5	20±2
Neutrophils lymphocyte ratio	6.3±1.0	4.5±0.5
Total no of patients	120	31

by Jeanette K et al⁶, Johannes TN et al⁷ & Dabbah S et al⁸, stated that Cardiac troponin I (cTnI) is the preferred biomarker for predicting not only short-term (30 days) but also long-term (1 year and beyond) outcomes in myocardial infarction (MI) and risk of death. They proposed that diagnostic accuracy of troponins within 2-4 h of symptom onset is limited due to the specific kinetics of this protein in the injured myocardium. The RDW is a measure of the heterogeneity of red blood cell size obtained from red blood cell size distribution curves, therefore RDW has been proposed as an independent predictor of mortality in non-ST-elevation MI reported by Azab B, et al,⁹ and these workers suggested that identification of patients with elevated troponin levels is especially useful for selecting the appropriate treatment in patients with non-ST-elevation acute myocardial infarction and the RDW has been shown to be predictive of morbidity and mortality in various cardiovascular diseases, such as heart failure, stable coronary artery disease and acute myocardial infarction. Erhan TI et al,¹⁰ also confirms our findings who founded that the ischemic ECG findings, increased LDL-C levels, presence of coronary thrombus, history of CABG, high cardiac troponin level, increased WBC count and the RDW were significant predictors of NSTEMI-AMI and they suggested that the RDW is a simple and economical laboratory measurement that has relatively good diagnostic accuracy in predicting NSTEMI-AMI in patients and troponin I released from the injured myocardium limits its usefulness within 2-4 h of symptom onset, while RDW

measurement would be helpful for predicting myocardial injury at an earlier stage of diseases. They reported that the RDW should be considered along with conventional cardiac markers for the prediction of NSTEMI-AMI in patients with NSTEMI-AMI and should serve as a guide for making appropriate treatment decisions. The RDW has been reported to be a strong independent predictor of coronary heart disease events in different cardiovascular conditions and risk of death would be higher in case of increased RDW among the patients with acute myocardial infarction reported by Kushang VP et al¹¹, Cavusoglu et al¹², Helfand M. et al¹³, Zalawadiya SK, et al¹⁴. The Neutrophil / Lymphocyte Ratio is an independent predictor of mortality in patients with ACS and this inexpensive marker of inflammation can aid in the risk stratification and prognosis of patients diagnosed with ACS reported by Tamhane UU et al¹⁵. In another study, Tonelliet al¹⁶, stated that among patients with CAD and without heart failure, mortality rates were significantly increased in patients with elevated RDW values compared with patients with RDW values within the normal range. Lippi et al¹⁷, investigated the role of the RDW in patients with chest pain suggestive of ACS. These researchers reported that the combined measurement of cardiac troponin and the RDW at admission increased the already impressive sensitivity of cardiac troponin from 94% to 99% in diagnosing AMI. In another study, by Ceminet al¹⁸, investigators studied the relationship between red blood cells, platelet morphology and AMI and also assessed whether

they could supplement the role of traditional cardiac biomarkers in the early identification of patients with AMI. The researchers found that the RDW predicted AMI with statistical significance only in female patients. The cardiac biomarkers such as troponin I, CK-MB, heart fatty acid binding protein B-type natriuretic peptide, ischemic modified albumin, GDF, copeptin and F2 isoprostanase were prognostic, diagnostic and treatment planning in acute myocardial infarction reported by Rosen Belt J et al¹⁹ and Sabesan M²⁰

CONCLUSION & RECOMMENDATIONS:

From the above discussion following conclusions and recommendation were made in our study

- Higher red cell distribution width value was associated with high total leucocyte count, parentage of neutrophils, neutrophils lymphocyte ratio and low density lipoprotein detected in patients with Non-ST elevation myocardial infarction
- The evaluation of troponin T level, inflammatory markers such as C-reactive Protein, interleucine-6 and tumor necrosis factor 2,3 and 5 and new cardiac markers were required that make the physician to able for the diagnosis, prognosis and management of acute myocardial infarction

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