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Assessment of the Severity of Acute Coronary Syndrome (ACS) and Its Correlation with Serum Indices

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ABSTRACT

Background: Acute coronary syndrome (ACS) is the syndrome including unstable angina pectoris and acute myocardial infarction syndrome, and is a common acute disease of cardiovascular system. The present study used red cell distribution width (RDW) value for the assessment of the severity of acute coronary syndrome (ACS) and its correlation with serum indices. **Methods:** A total of 90 cases of patients diagnosed with acute coronary syndrome and 90 cases of healthy individuals receiving physical examination were selected for study, and their serum was collected to detect RDW levels as well as the levels of cardiac biomarkers in the serum. **Results:** In our study, 90 cases of acute coronary syndrome had greater values of RDW (mean16.29%) as compared to 90 age and gender matched controls mean 11.50%) with p-value of <0.001. It was also noted that, RDW values of patients of STEMI was greater than patients of NSTEMI and Unstable Angina. **Conclusion:** RDW can assess the severity of acute coronary syndrome and is associated with degree of inflammatory response, myocardial ischemia and endothelial protection.

Keywords: acute coronary syndrome, Red cell distribution width, RDW, STEMI.

INTRODUCTION

Acute Coronary Syndrome is the most common form of heart disease world-wide and the single most important cause of premature death. The disease of the coronary arteries is almost always as a resultant of atheroma formation and its associated complications. Atherosclerosis is an advancing inflammatory disorder of the arterial wall which is characterized by formation of atheroma leading to occlusion of the vessel. It can affect any artery in the body and it begins in early life.[1]

One of the precipitating factors for the progression of atherosclerosis is presence of inflammation. Atherosclerosis begins with deposition of focal lipid rich deposits of atheromas that remain clinically dormant until they enlarge and impair tissue perfusion.[2] A vulnerable atherosclerotic plaque is characterized by a lipid rich core, a thin fibro-cellular cap and increased inflammatory cells that release specific enzymes to degrade the matrix proteins. As the vulnerable plaque ruptures, it consecutively leads to thrombus formation and occlusion of the affected coronary vessel, causing ischemia and necrosis of the subtended myocardium. These events that occur in the coronary arteries are termed as Acute Coronary Syndrome.[3]

Red blood cell distribution width (RDW) is a routinely measured parameter by modern Hematology analyzers. RDW is a commonly used parameter to assess the degree and type of anemia. Recent studies show that RDW can also be used as a prognostic marker for patients with heart failure.[4] Subsequent studies have confirmed the significance of RDW as a predictor of mortality in patients of various diseases including peripheral artery disease (PAD), Chronic Obstructive Pulmonary Disease (COPD), and end-stage renal failure.[5] The present study was conducted to establish a correlation between the RDW values of patients of acute coronary syndrome and cardiac biomarkers in assessing the severity of ACS as compared to normal healthy individuals.

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MATERIALS AND METHODS

The present study was conducted in the department of General Medicine. It comprised of 90 patients of Acute Coronary Syndrome and equal number of control. The study was approved from ethical committee. All patients were informed regarding the study and written consent was obtained.

Data such as name, age, gender etc. was recorded. Reason for admission, anthropometry and documentation of past illness and family history were documented. The severity was assessed using TIMI score and KILLIP class.

Immediately after admission to critical care unit, blood was drawn for investigation of cardiac biomarkers, complete blood hemogram, serum creatinine values and lipid profile. Blood samples were collected in clot activator vials were sent to laboratory where serum was separated and respective serum indices' levels are estimated. The cardiac biomarkers i.e. CPK-MB and Cardiac troponin- I were estimated using Chemilumiescent technology, by Vitros 250 and Vitros–ECI respectively.

RESULTS

Table 1: Distribution of cases according to type of myocardial wall involved

Type of wall	Number	%
AWMI	37	41.1
IWMI	38	42.2
LWMI	10	11.1

[Table 1] shows that 41.1 % of cases showed anterior wall of myocardium involvement in MI (AWMI) 42.2 % showed the involvement of inferior wall (IWMI) and the rest 11.1 % had involvement of lateral wall of the myocardium.

Table 2: Cases according to type of Ischemic Heart Disease

Type of IHD	Number	%
STEMI	62	68.9
NSTEMI	21	23.3
Unstable Angina	7	7.8

[Table 2] shows that 68.9% cases were of ST elevation MI, 23.3% had Non ST elevation MI and 7.8% of the cases had unstable angina.

Table 3: Lipid Profile in Cases of Acute Coronary Syndrome

Lipid Profile	Abnormal		Normal	
	N	%	N	%
Triglycerides (Elevated)	41	45.6%	49	54.4%
Total Cholesterol (Elevated)	56	62.2%	34	37.8%
HDL (Declined)	30	33.3%	60	66.7%
LDL (Elevated)	49	54.4%	41	45.6%
VLDL (Elevated)	21	23.3%	69	76.7%

[Table 4] shows that that in 56 patients, total cholesterol was abnormal followed by LDL in 49, TG in 41, HDL in 30 and VLDL in 21.

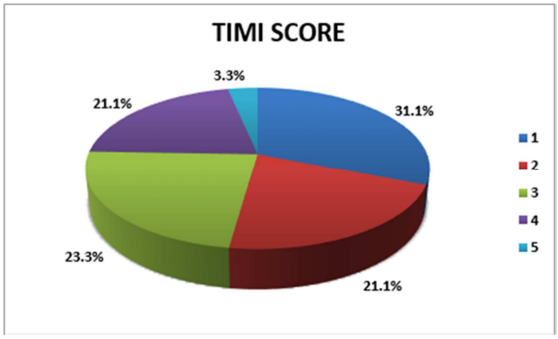

Figure 1: Distribution of TIMI Score

[Figure 1] shows that maximum patients had TIMI score of 1 seen 31.1% followed by 3 in 21.1%.

Table 4: Distribution of KILLIP Class

KILIP Class	Number	%
1	35	38.9
2	37	41.1
3	16	17.8
4	2	2.2
Total	90	100

[Table 4] shows that maximum patients had KILP score of 2 seen in 37.

[Table 5] shows that RDW values are significantly high in cases of MI as compared with that of controls.

Table 5: Comparison of Hemoglobin and RDW Between Cases and Controls

Parameters	Cases		Controls		t value	p value
	Mean	SD	Mean	SD		
HB (gm/dl)	12.51	1.17	12.48	1.09	0.164	0.870
RDW (%)	16.29	1.75	11.50	0.91	23.05	<0.001*

Table 6: Correlation Between RDW (%) and TIMI SCORE AND KILLIP CLASS

Parameters	Correlation Coefficient	p value
TIMI & RDW	0.039	0.715
KILLIP Class & RDW	0.245	0.020*

[Table 6] shows that a positive correlation between TIMI SCORE and RDW which was not statistically significant but the correlation between KILLIP CLASS and RDW is a strong and positive one which is statistically significant (p=<0.05).

Table 7: Change in mean RDW (%) according to 2D Echocardiography parameters

Parameters		RDW		p value
		Mean	SD	
Regional Wall Motion Abnormality	PRESENT	16.48	1.55	0.011 *
	ABSENT	15.15	2.41	
Diastolic Dysfunction	PRESENT	16.55	1.59	0.003 *
	ABSENT	15.17	2.01	
LVEF (%)	25%-35%	16.64	1.62	0.040 *
	35%-45%	15.77	1.67	
	>45%	15.41	2.45	

[Table 7] shows that Mean RDW value with presence of RWMA is 16.48% (p=0.011), with presence of diastolic dysfunction it is 16.55% (p=0.003) and poorer left ventricular ejection fraction was seen with higher values of RDW (p=0.04); Thus strongly suggesting a positive correlation between RDW and these 2D Echocardiography parameters and it is statistically significant.

DISCUSSION

Acute Coronary Syndrome (ACS) includes acute myocardial infarction (STEMI and NSTEMI) and unstable angina pectoris (UAP). ST-Elevation Myocardial Infarction (STEMI) and Non-ST elevation Myocardial Infarction (NSTEMI) are the components of Acute Myocardial infarction.[6]

RDW is defined as the quotient of standard deviation of red blood cell volume and is expressed as a percentage according to the following formula: RDW= (standard deviation of red blood cell volume / mean cell volume) x 100. Red blood cell distribution width is a measure of degree of anisocytosis that is it is a measure of degree of variations in red blood cell volume.[7]

Red cell distribution width (RDW) is an index that is used in measurement of variability of red blood cell size and volume, higher the RDW value indicates higher degree of variability. Regardless of development in effective treatments heart disease remains the foremost cause of mortality and morbidity all around the world. Thus there is an urgent need for assessment of easy, inexpensive, rapid and reliable index for predicting clinical outcomes in patients of acute coronary syndrome and risk of future major cardiac events. As mentioned before anisocytosis i.e. variations in erythrocyte volume, and it may be dependent on not only clinical variables but also on many demographic factors.[8] The erythrocytes of variable size and volume are released from bone marrow under the influence of many factors such as birth season, age physical activity and numerous red blood cell disorders such as anemia related to iron deficiency, folate and B12 deficiency, genetic diseases, (sickle cell anemia, thalassemia), hemolytic anemia and transfusions.[9]

We found that out of 90 cases of ACS, there were 62 STEMI, 21 NSETMI and 7 unstable anginas. The mean RDW values of patients of ACS in our study were 16.29% and that of controls was 11.50% which is significantly higher than that of healthy controls. This finding is similar to other studies, like Guo-Dong Cheng et al,[10] and Naguna Karamuri et al.[11]

In this study, multivariate regression analysis demonstrated RDW to be an independent predictor of coronary artery disease. Also the Receiver Operating Characteristic (ROC) curve analysis showed that the RDW value of 12.95% is an effective cut off point in diagnosing coronary artery disease with a sensitivity of 96.7% and specificity of 87.8%. Naguna et al,[11] had demonstrated that RDW value of 14.3% had specificity of 84.8% in diagnosing Coronary artery disease and Alejandro Rosas-Cabral et al,[12] found RDW value of 14.1% to be effective and Akin et al,[13] found RDW value of 15.1% as the most significant value associated with higher severity of coronary artery disease. Thus our study shows that effective cut off for RDW is much lower with a better sensitivity and specificity value in diagnosing acute coronary syndromes. However, we would like to add that much work needs to be carried out in establishing an effective and consistent value for RDW in diagnosing ACS Our study also demonstrated a positive correlation between RDW values and TIMI and Killip class, with a p value of 0.020 we reiterated that the patients with higher RDW values had worse TIMI and Killip scores. This finding was consistent with other studies such as, Rosas-Cabral et al.[14] In our study there was positive correlation of RDW values with that of cardiac biomarkers like CPK-MB and Troponin. Thus indicating that greater values of RDW were associated with increased degree of myonecrosis.

CONCLUSION

This study shows that there is a strong correlation between the severity of Acute Coronary syndrome and RDW values. There is a positive correlation between the RDW value in predicting AMI and degree of myonecrosis. RDW value can be considered as an important, inexpensive parameter of prognosis in patients of AMI.

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