Original article

Correlation between Red Cell Distribution Width and Coronary Artery Disease Severity in non-diabetic patients of Punjab Institute of Cardiology (PIC)

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ABSTRACT

Background: Coronary artery disease (CAD) is one of the major causes of morbidity and mortality. The most accurate method of assessing CAD is angiography. Red cell distribution width (RDW) is the quantitative measure of the size variation of circulating erythrocytes. Recently, red cell distribution width has emerged as a marker of CAD severity. The objective of this study is to evaluate the correlation between RDW and CAD severity. RDW is a simple blood test performed in routine patients, which is why it was chosen for correlation. Compared with angiography, which is cost-effective but time-consuming, this simple test can be performed before angiography to assess CAD severity. This will reduce patient burden in tertiary care hospitals and also decrease the patient anxiety rate regarding an invasive process like angiography.

Patients and methods: Eighty patients who underwent coronary angiography at the Punjab Institute of Cardiology (PIC), Lahore, were selected. The Gensini score was used to calculate CAD severity. RDW was obtained from an automated haematology analyser. The correlation between RDW and Gensini score was then statistically analysed by Spearman's correlation. This was a cross-sectional analytical study conducted at the Punjab Institute of Cardiology (PIC), Lahore. A total of eighty patients undergoing "elective "coronary angiography were selected (inclusion criteria). Patients with diabetes mellitus, cerebral infarction, haematological diseases, hepatic diseases, and renal diseases were excluded (exclusion criteria). There were 57 males and 23 females. It was graded and classified only. The severity score (for vessel wall blockage) ranges from 1 to 32 and was included.

Results: The study population included 57 (71.3%) males and 23 (28.7%) females. The mean age of the population was 55.28±11.1 years. Among the 80 patients, 71 (71/80, 88.75%) were diagnosed with CAD on angiography and out of these, 21 (21/71, 29.5%) patients had one vessel disease, 22 (22/71, 28.5%) had two vessel disease, and 28 (28/71, 39.4%) had three vessel disease. The median and IQR of the Gensini score of the whole population were 28 (6.5-56). With one vessel involvement, the median and IQR were 10 (5.7-30); with two vessel involvement, 34 (14-56); and with three vessel involvement, 56 (29-99). A non-significant correlation was observed between RDW and the Gensini score (rho = 0.028, p = 0.808). Rho (is the strength of association between two variables.)

Conclusion: No significant correlation between RDW and coronary artery disease severity was observed; sample size may have been a limiting factor.

Keywords:
Red cell distribution width, coronary artery disease, Gensini score

INTRODUCTION

The term "coronary artery disease" was previously thought to be a simple process of arterial narrowing. However, it comprises a range of diseases that result from atheromatous changes in coronary arteries, from a stable, lipid-poor, thick fibrous cap to an unstable, lipid-rich, thin fibrous cap.[1] CAD is one of the leading causes of death, both in developed and developing countries.[2] Pakistan is considered a high-risk country for CAD among other countries around the globe.[3] Coronary angiography is the gold standard for its diagnosis.[4-6] But this procedure is costly and invasive. This led to a search for other markers as predictors of morbidity and mortality in these patients. Red cell distribution width (RDW) is a novel risk marker reported to be higher in CAD patients at higher mortality risk.[7-9] It has been described as closely related to cardiovascular events such as heart failure, acute coronary syndrome, ischemic cerebro-vascular disease, peripheral artery disease, atrial fibrillation and hypertension.[10] RDW is a quantitative measurement of the size variation in the circulating erythrocytes.[11] The reference range for RDW is 39-46 fl.[12] RDW is raised under some physiological and pathological conditions. It is increased in conditions such as iron, vitamin B12 and folate deficiency; sickle cell anaemia; β-thalassemia;

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immune hemolytic anaemia; cytotoxic chemotherapy; chronic liver disease; diabetes mellitus; and renal disease.[13] These diseases were taken as co-existing confounders, as RDW is affected in these diseases (were a part of the exclusion criteria). Clinical laboratories routinely report RDW as a component of CBC reports and make it available for most patients. Understanding its prognostic value could be very helpful for risk stratification in clinical decision-making. However, whether the prognostic effect of RDW is specific to patients with cardiovascular disease (CVD) or rather is also valid in the general population is unknown. Therefore, the current study was conducted to determine whether elevated RDW values are linked with coronary artery disease severity.

PATIENTS AND METHODS

This was a cross-sectional analytical study conducted at the Punjab Institute of Cardiology (PIC), Lahore, for 6 months. RDW and Gensini score were studied. A total of eighty patients undergoing elective coronary angiography were selected. Patients with diabetes mellitus, cerebral infarction, hematological diseases, hepatic diseases, and renal diseases were excluded. There were 57 males (71.3%) and 23 females (28.7%). The mean age of patients was 55.28 ± 11.1 years, with 50 patients in the >50 years age range and 30 patients in the 30-50 years age range. Red cell distribution width was measured on an automated haematology analyser. Coronary angiography was done in the PIC, Lahore.

CAD is caused by plaque buildup in the arteries that supply blood to the heart. The severity of CAD was assessed by the already done angiography of the patient. The Gensini severity score, which measures the extent of coronary artery disease, was calculated based on the degree of stenosis; a severity coefficient was assigned to each segment (0, 1, 2, 4, 8, 16, or 32, depending on the degree of narrowing). The segment was rated from 5 (left main trunk) to 0.5 (most distal segments). As a consequence, total digital Gensini scores were obtained that indicated the severity of CAD.[14]

Data was collected by non-randomised convenience sampling. SPSS 20 was used for data analysis. The mean was used for continuous variables, and the median for categorical variables. The Spearman correlation coefficient was used to calculate the correlation between the variables.

RESULTS

The study population included 57 (71.3%) males and 23 (28.7%) females. The mean age of the population was (55.28±11.1) years, with (50 patients in the >50 years age range) and (30 patients in the 30-50 years age range. Among the 80 patients, 71 (71/80, 88.75%) were diagnosed with CAD on angiography and out of these, 21 (21/71, 29.5%) patients were having one vessel disease, 22 (22/71, 30.9%) were having two vessel disease and 28 (28/71, 39.4%) were having three vessel disease. In contrast, the remaining 9 patients (9/80, 11.25%) did not have coronary artery disease. The median and IQR of the Gensini score of the whole population were 28 (6.5-56). With one vessel involvement, the median and IQR were 10 (5.7-30); with two vessel involvement, 34 (14-56); and with three vessel involvement, 56 (29-99). The study population showed a median (IQR) of red cell distribution width of 45 (46-48). With one-vessel disease, the median and IQR were 45 (42-47), and with two-vessel disease, the median and IQR were 47 (44-48). With triple vessel involvement, the median and IQR were 45. A non-significant correlation was seen when RDW was correlated with Gensini score by applying Spearman's correlation with rho (Spearman's coefficient = 0.028 and p = 0.808)

DISCUSSION

The study found that 38 patients with CAD had higher RDW values. However, no correlation was found between RDW and CAD severity. Khalil and coworkers described 100 diabetic patients and found no consistent correlation between RDW and diseased coronary arteries with significant stenosis.[15] Similarly, another study on 269 patients with stable CAD showed no correlation between RDW values and significant stenotic lesions.[16] In a study done on 233 diabetic patients, higher RDW values were related to severe coronary lesions as indicated by higher Gensini scores.[17] In another study done on 291 patients by Karacaglar and co-researchers, the RDW levels were significantly higher in patients with CAD as compared to those with normal coronary arteries. This indicated a trend of positive correlation between RDW and CAD. Several theories have been postulated in this regard. One important mechanism is inflammation, which not only contributes to the development of atherosclerosis but also inhibits RBC maturation through released cytokines. As immature red cells enter circulation, there is greater diversity in cell size, resulting in higher RDW values.[18] The other contributor is oxidative stress during the development of the atherosclerotic process. Free radicals damage the red cell membrane, disturb the energy metabolism, and decrease the erythrocyte life span.[19] The compensation is an increased proportion of

immature RBCs in the circulation, which leads to an elevation of RDW.[20] The most likely reason for the deviation of the present study from the seen trend of positive correlation is the small sample size.

CONCLUSION

No significant correlation between RDW and coronary artery disease severity was established in this study; sample size may have been a limitation. Further studies are required with a larger sample size and to determine the potential mechanisms linking coronary artery disease severity with increased RDW.

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