

ORIGINAL ARTICLE

HEMATOLOGICAL PARAMETERS IN CARDIOVASCULAR DISEASES

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Background: Cardiovascular diseases are one of the leading causes for morbidity and mortality worldwide. They are mainly caused by atherosclerosis and its complications. Limited literature is available on the role of various haematological parameters. Our objective was to study various haematological parameters like RBC count, Haemoglobin, Haematocrit, Mean Corpuscular Volume (MCV), Mean Corpuscular Haemoglobin (MCH), Red Cell Distribution Width (RDW) in patients with Coronary Artery Disease (CAD). **Methods:** This was a descriptive study carried out on patients with CAD admitted to Sri Jayadeva Institute of Cardiovascular Sciences and Research, KRHospital Campus, Mysore, India in the age range of 30–60 years. Patients with impaired renal or hepatic function, known congenital heart disease/valvular heart diseases, known case of anaemia or being treated for anaemia, prolonged drug intake, thyroid disorders were excluded from the study. Blood samples were collected in an EDTA vacutainers and analysed in automated cell analysers. **Results:** About 26.7% of the patients were <40 years age, 31.7% between 41–50 years and 41.7% were in 51–60 year group; 28.3% were known patients of hypertension, while 43.3% had diabetes mellitus. Haemoglobin in 48.3% of the study population was within normal range, while 16.7% of them had low levels and 35% had higher levels. Eighty percent of them had normal RBC count, 15% had increased count and 5% had decreased count. Fifty percent subjects had normal PCV while 20% had increased and 30% had decreased values. There was increased RDW-SD and RDW-CV in 66.7% and 50% of the study population respectively. **Conclusion:** There is role of various parameters like haemoglobin, MCV, RDW in pathogenesis of CAD. Alterations in various haematological parameters over a long run may be one of the various other reasons for the development of CAD. Regular health check-ups with precautionary measures taken in advance may reduce the prevalence of the disease.

Keywords: Coronary Artery Disease, haematological parameters, RDW

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INTRODUCTION

Cardiovascular diseases (CVD) are the leading cause of death globally, more people die annually from CVDs than from any other cause. They include Coronary Artery Disease (CAD), stroke, peripheral vascular disease, heart failure, venous thromboembolism and pulmonary arterial hypertension. There has been an alarming rise in coronary artery disease in India. Epidemiological studies from various parts of India indicate prevalence of coronary heart disease to be between 7% and 13% in urban and between 2% and 7% in rural population. Although the classical risk factors are very important, identification of potential risk factors involved in the development of CVD could prove to be beneficial in prevention and treatment of the disease. Much research has been done on the role of platelets in the development of atherosclerosis^{1,2} and its complications, the major cause for cardiovascular diseases.

Limited literature is available on the role of RBCs in explaining the pathophysiology of CVD. Red Blood Cells are constituents of intravascular clots. RBCs may play a prothrombotic role in blood coagulation by increasing blood viscosity and forcing platelets towards the vessel wall.^{3–5} Incorporation of

RBCs into fibrin clot affects clot structure and mechanical properties.⁶ Even small structural differences in RBCs may have large influence on pathophysiology. RBCs may actively participate in thrombin generation.⁷

Recently it has been suggested that there might be a relationship between haemoglobin level and CAD.⁸ Few studies have shown an association between haematocrit and cardiovascular risk.^{9,10} Recent studies have shown that Red cell Distribution Width (RDW) is associated with several cardiovascular diseases¹¹ and is an independent predictor of cardiovascular events in patients with history of myocardial infarction¹². However some studies have found no association between haematocrit, RDW and coronary artery disease.¹³

It has been reported that the prevalence of CAD in diabetic population ranges from 9.5% to 55%,^{14,15} whereas in general population it is reported to be 1.6 to 4.1%¹⁶. It is observed in a study done on south Indian population that irrespective of gender, diabetes along with dyslipidemia are major risk factors for CAD.¹⁷ This study was aimed at evaluation of various RBC parameters to identify their role in Coronary Artery Disease.

MATERIAL AND METHODS

This is a descriptive study carried out on patients with coronary artery disease admitted to Sri Jayadeva Institute of cardiovascular sciences and Research, KR Hospital Campus, Mysore. Subjects in the age group of 30–60 year were included. Patients with diabetes, hypertension, hyper-cholesterolemia, and hypertriglyceridemia were included. Patients with impaired renal or hepatic function, known congenital heart disease/valvular heart diseases, known case of anaemia or being treated for anaemia, prolonged drug intake, thyroid disorders, women on oral contraceptive pills or pregnant were excluded from the study.

The subjects who were undergoing coronary angiography were randomly selected; 28.3% of them were known patients of hypertension, and 43.3% had diabetes mellitus and were on treatment. The study was done over a period of 3 months. Patients' age, sex, history of hypertension, Diabetes Mellitus (DM) and the medications used were recorded. The minimum sample size was calculated as 23 considering Standard Deviation of RDW in CAD patients as 1.3, mean as 14.1 with relative precision 5% and confidence level 99%.¹² However, all cases undergoing coronary angiography in the study period, after considering the inclusion and exclusion criteria were included.

Venous blood samples were collected in an EDTA vacutainers within six hours of admission. All samples were analysed in automated cell analyser, Medonic® M Series which computed the value of the parameters, i.e., RBC count, Haemoglobin, Haematocrit, Mean Corpuscular Volume (MCV), Mean Corpuscular Haemoglobin (MCH), Mean Corpuscular Haemoglobin Concentration (MCHC), and Red cell Distribution Width (RDW).

Data were entered into Microsoft Excel (Windows 7; Version 2007) and analyses were done using SPSS-22. Descriptive statistics such as Mean and Standard Deviation (SD) for continuous variables, and frequencies and percentages for categorical variables were determined.

RESULTS

Distribution of the subjects according to various haematological parameters is tabulated in Table-1. Haemoglobin, RBC Count, PCV, MCH, and RDW are tabulated as frequency, percentage, and range, and Mean±SD for the observed values of the study parameters are calculated.

Majority of the patients were in the age group of 41 to 60 years with the mean age of 48.1 years. The haemoglobin level in 48.3% of the study population was within normal range, while 16.7% of them had low levels and 35% had increased levels.

Table-1: Distribution of subjects according to haematological parameters (N=60)

Parameter	No.	%	Range	Mean±SD
Hb (g%)				
≤12	10	16.7	8.0–18.6	14.32±2.48
12–15	29	48.3		
>15	21	35.0		
RBC (Million/Cm³)				
≤3.5	3	5	0.03–6.99	4.73±0.95
3.5–5.5	48	80		
>5.5	9	15		
PCV				
≤36	12	20	3.0–56.0	41.05±8.76
36–45	30	50		
>45	18	30		
MCH				
≤27.5	9	15.0	17.4–36.3	29.76±3.58
27.6–32.2	38	63.3		
>32.2	13	21.7		
RDW-SD				
≤57.5	20	33.3	35.8–84.9	61.77±10.15
>57.5	40	66.7		
RDW-CV				
≤14	0	0	14.2–21.2	16.21±1.21
14–16	30	50		
>16	30	50		

DISCUSSION

Haemoglobin concentration can affect the cardiovascular system through oxygen supply and viscosity.¹⁴ Increased as well as decreased levels of haemoglobin are independently associated with increased risk for CAD.¹⁵ In a study done on patients referred for elective coronary angiography, revealed that lower quartiles of haemoglobin levels were independently related to the presence of CAD.¹⁶

Eighty percent (80%) of our subjects fell within normal range of RBC count, 15% had increased count and 5% had decreased count. RBC contribute to thrombus formation. Clinical observations suggest that a variety of bleeding disorders can be treated by elevation of RBC counts, even when platelet levels decrease or remain unchanged.¹⁷ Increased RBC counts predispose to thrombosis by increasing the blood viscosity which leads to obstruction. It has been shown that RBCs perform signalling role in haemostasis by promoting platelet aggregation and degranulation by releasing ATP and ADP under low P_{O_2} and low pH in response to mechanical deformation.¹⁸ They contribute to activation of coagulation cascade by losing their phospholipid asymmetry thereby serving a procoagulant surface. This is especially important in conditions like DM.¹⁹

Majority of the study subjects had normal PCV, while 20% had increased, and 30% had decreased values. PCV or Haematocrit is the percent of blood volume filled by erythrocytes and thus measures oxygen carrying capacity of the blood. High haematocrit increases the residence time of circulating platelets and coagulation factors near the activated endothelium, because it promotes the transport of platelet towards the

vessel wall, thereby increasing their collisions with the vasculature.¹⁷ Increased values of haematocrit was demonstrated in a study done on patients with coronary heart disease.²⁰

Mean Corpuscular Volume (MCV) is a parameter related to the volume of the erythrocyte while MCH is an indicator of the amount of haemoglobin erythrocyte includes. MCV and MCH values were reported to be significantly higher in angiography positive CAD group when compared to angiography negative CAD group.²¹ It suggests that erythrocyte morphology and the amount of haemoglobin in erythrocyte can be significant in development of CAD.

Red cell Distribution Width is a parameter routinely measured by most of the modern day automated blood cell counters. It is defined as quotient of standard deviation of red cell volume and its mean volume, expressed as percentage in 2 ways: RDW-CV and RDW-SD. It is a measure of red cell size variation and is an index of heterogeneity of erythrocytes. It is based on the width of RBC volume distribution curve with larger values indicating greater variability. In the present study there is increased RDW-SD and RDW-CV in 66.7% and 50% of the subjects respectively. Studies have reported a strong independent relation between levels of RDW and risk of death and cardiovascular events in people with prior CAD.^{12,22} Some studies have shown that elevated RDW levels are also associated with increased in hospital mortality among patients suffering from myocardial infarction.²³ RDW itself correlates with both severity and complexity of coronary artery atherosclerosis determined using the syntax score.²⁴ RDW levels may be related to subclinical inflammation as it is increased in many inflammatory diseases.

RDW is associated with poor prognosis in patients with stable CAD. Although the mechanism remains speculative, elevated levels have been demonstrated to be associated with increased hemodynamic and oxidative stresses. Diabetes and hypertension are known risk factors that influence the RDW.^{25,26}

CONCLUSION

There is role of various parameters like haemoglobin, MCV, RDW in pathogenesis of Coronary Artery Disease. Alterations in various haematological parameters over a long run may be one of the various reasons for development of CAD. Regular health check-ups with precautionary measures taken in advance may reduce the prevalence of the disease.

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