International Journal of Medical and Pharmaceutical Research
Website: https://ijmpr.in/| Print ISSN: 2958-3675 | Online ISSN: 2958-3683
NLM ID: 9918523075206676
Volume: 4 Issue:3 (May-June 2023); Page No: 708-712

Original Article

Study of Red Cell Distribution Width in Heart Failure Patients and its Correlation with Severity of Heart Failure

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ABSTRACT

Background: Heart failure is a prevalent and chronic condition with a rising incidence globally, including in India. Red cell distribution width (RDW), a measure of erythrocyte size variation, has been proposed as an indicator of inflammation and oxidative stress in cardiovascular diseases, including heart failure. However, limited data exist on the relationship between RDW and heart failure severity in Indian patients. This study aimed to investigate the correlation between RDW and the severity of heart failure in Indian patients.

Result: The study included patients across various age groups, with the majority falling in the 51-60 years range, and most of the patients were male. Hypertension was the most common risk factor for heart failure, followed by dyslipidemia and obesity. Ischemic heart disease emerged as the primary cause of heart failure in the studied population. Distribution of patients based on NYHA classes revealed a higher percentage in the more severe classes (III and IV). The mean RDW was significantly higher in patients with advanced heart failure compared to those with milder forms.

Conclusion: The study findings indicate a correlation between elevated RDW and increased severity of heart failure in Indian patients. RDW shows potential as a biomarker for risk stratification and monitoring disease progression in this population. Further research is needed to explore the clinical utility of RDW in the early detection and management of heart failure, along with its implications for developing new therapeutic approaches specific to the Indian context.

Key Words: *Heart failure, RDW (Red cell distribution width), ischemic heart disease, Anaemia*

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INTRODUCTION

Heart failure is a prevalent and chronic condition that affects millions of people worldwide, and its incidence is on the rise due to several risk factors like hypertension, obesity, and diabetes. Red cell distribution width (RDW), which measures the variation in the size of red blood cells, has been proposed as a potential indicator of inflammation and oxidative stress in various cardiovascular ailments, including heart failure. This study aims to explore the relationship between RDW and the severity of heart failure in Indian patients.

Heart failure poses a significant public health challenge globally and is linked to increased morbidity and mortality. The Global Burden of Disease study found that heart failure was responsible for over three million deaths globally in 2017, accounting for 2.8% of all deaths [1]. It is projected that the prevalence of heart failure will continue to surge in the coming years, particularly in developing countries, owing to the aging population and the increasing incidence of risk factors such as hypertension and diabetes.

In India, cardiovascular diseases, including heart failure, are the primary cause of death, accounting for about 28% of all fatalities [2]. A recent study estimates that the prevalence of heart failure in India is around 1-2% of the total population [3], and it is expected to rise due to the high prevalence of risk factors such as hypertension, diabetes, and ischemic heart disease.

Despite the high burden of heart failure in India, there is limited data on the link between RDW and the severity of heart failure in Indian patients. Therefore, more research in this area is essential to identify potential markers that can aid in the early detection and management of heart failure in India. The results of this study would have significant implications for heart failure management in India. If RDW is associated with the severity of heart failure, it could serve as a potential biomarker for risk stratification and monitoring of disease progression in Indian patients. Additionally, it could aid in the development of new therapeutic approaches for heart failure management.

OBJECTIVE

To investigate the correlation between red cell distribution width (RDW) and heart failure (HF) severity by echocardiography.

MATERIALS AND METHODS

This prospective randomized study included 50 patients who had a clinical diagnosis of heart failure. The study was approved by the ethics committee of the institution, the study included patients between the ages of 20 and 80 who were diagnosed with heart failure based on history, physical examinations, and echocardiography. Patients who were newly diagnosed with heart failure based on the European Society of Cardiology criteria and those with follow-up cases of heart failure in a decompensated state were also included. Patients who refused consent, had congenital heart diseases, severe anaemia, chronic obstructive pulmonary disease, neoplastic metastasis to bone marrow, pregnancy, liver diseases, inflammatory bowel diseases, hypothyroidism, recent blood transfusions within the past three months. On the day of admission, all patients had a complete blood count with RDW measured, along with an ECG, echocardiogram, chest X-rayand all patients provided informed consent before participation.

The patients were categorized according to the NYHA functional classes of HF, which are based on symptom severity and limitations in physical activity. Class I: No symptoms and no limitation. Class II: Mild symptoms and slight limitation during ordinary activity. Class III: Marked limitation in activity due to symptoms, even during less than ordinary activity Class IV: Severe limitations.

RESULTS

The age-wise distribution of the 50 patients included in the study was found to be quite varied as seen in table 1,Most of the patients (32.0%) were in the age group of 51-60 years, followed by those in the age group of 41-50 years (26.0%). Patients in the age groups of 31-40 years (16.0%) and over 61 years (20.0%) were also included in the study, whereas patients below the age of 30 years accounted for only 6.0% of the study population. This distribution highlights the fact that heart failure can affect individuals across a wide range of age groups, and not just the elderly.

Table 1: Age wise distribution among participants

AGE	COUNT	PERCENTAGE
<30	3	6.0 %
31-40	8	16.0 %
41-50	13	26.0 %
51-60	16	32.0 %
>60	10	20.0 %

Table 2: sex wise distribution

GENDER	COUNT	PERCENTAGE
M	33	66%
F	17	34%

Out of the 50 patients included in the study, approximately 66% were male and 34% were female. Incidence of HF is more with increasing age and male gender as seen in table 2.

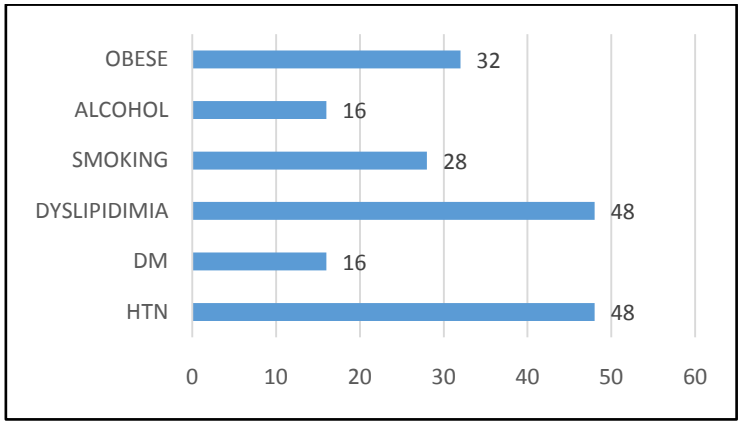

Figure 1: Distribution of risk factor among the study participants

According to our study, hypertension was the most common risk factor for heart failure, accounting for 48% of the cases. Dyslipidemia and obesity were also identified as risk factors, with 42% and 35% of the patients having these conditions, respectively. Smoking and alcohol consumption were less prevalent, with 28% and 16% of the patients reporting these habits, respectively. Diabetes mellitus was observed in 16% of the patients.

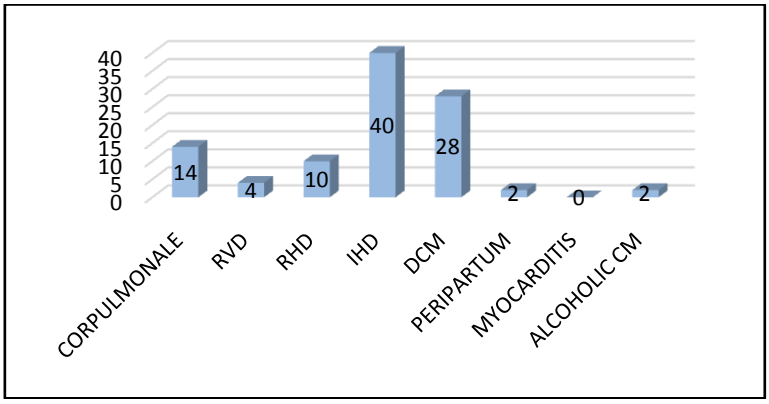

Figure 2: Etiology of heart disease among the study participants

The etiology of HF is depicted in Figure 2, The study found that the most common cause of heart failure among the patients was ischemic heart disease (IHD) with a percentage of 40.0%. Dilated cardiomyopathy (DCM) was the second most common cause with a percentage of 28.0%. Other causes included rheumatic heart disease (RHD) at 10.0%, cor pulmonale at 14.0%, right ventricular dysfunction (RVD) at 4.0%, peripartum at 2.0%, and alcoholic cardiomyopathy at 2%. No cases of myocarditis were observed in the study.

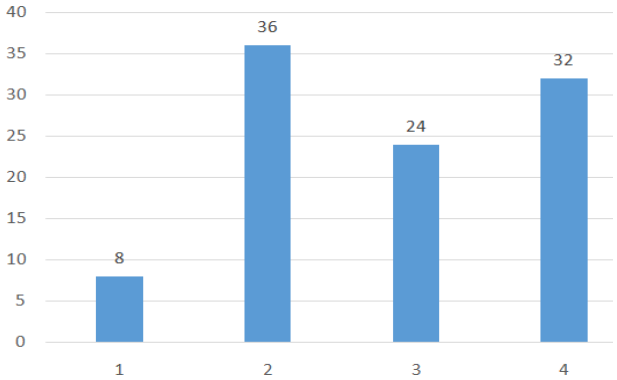

Figure 3: NYHA classification of heart disease

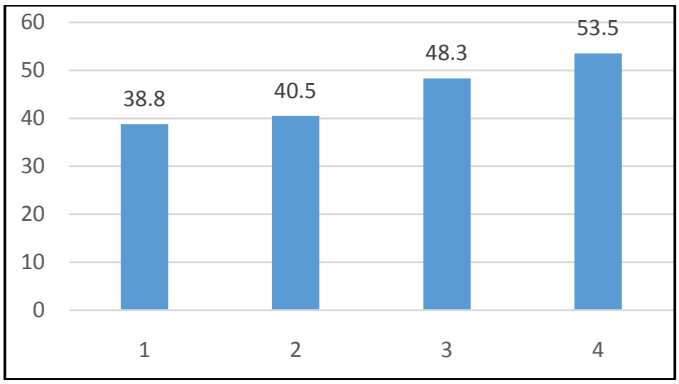

Figure 4: Mean red cell distribution width according to NYHA classification.

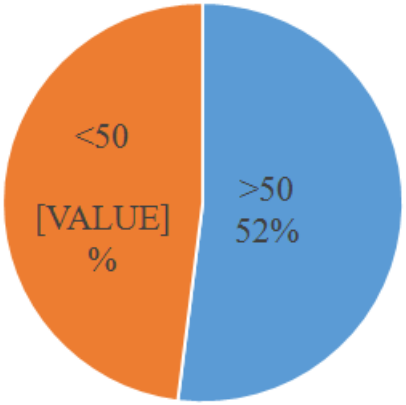

Figure 5:Percentage of ejection fraction

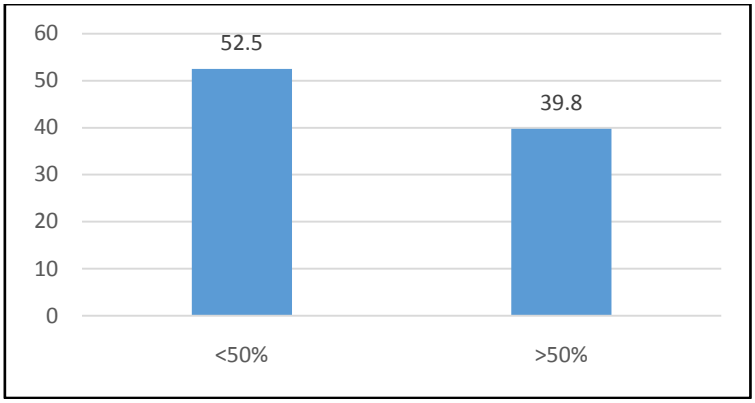

Figure 6: Elevated red cell distribution width is associated with low ejection fraction

According to the NYHA classification, the percentage of total patients in each class was as follows: Class 1 - 8.0%, Class 2 - 36.0%, Class 3 - 24.0%, and Class 4 - 32.0%.

The study found that the mean RDW for each NYHA class was as follows: Class I - 38.8 fL, Class II - 40.5 fL, Class III - 48.3 fL, and Class IV - 53.5 fL. The standard deviation was 3.16 for Class III and 4.24 for Class IV. It should be noted that the normal reference range for RDW is typically 39-46 fL. The results indicate that patients in Class III and IV had a significantly higher mean RDW compared to those in Class I and II. It was found that 52% of the patients had a low EF (<50%). Among those patients, the mean RDW was 52.5% the findings indicate that an increased RDW is associated with low EF and high risk of HF.

DISCUSSION

Heart failure (HF) is a major global health issue, and its prevalence is rapidly increasing despite advances in diagnosis and treatment. Therefore, there is a need for new biomarkers to improve the prognosis and management of HF patients[4]. Recent research has investigated the role of red cell distribution width (RDW)[5]as a possible biomarker for morbidity and mortality prediction in HF patients. RDW is a measure of the variation in erythrocyte size and has been shown to be useful in cardiovascular diseases, including HF. Several mechanisms, such as impaired hematopoiesis, inflammation [6], and oxidative stress [7], have been proposed to explain the association between RDW and HF. Impaired renal function is another factor that can contribute to anisocytosis and alteration in RDW in patients with HF, particularly in the elderly. Renal dysfunction can lead to an accumulation of uremic toxins[8], which can impair erythropoiesis and lead to anisocytosis. Routine measurement of RDW may provide essential prognostic information in HF patients, but more research is necessary to establish its clinical usefulness.

In our study, we recruited patients with heart failure whose age ranged from 25 to 79 years, with a mean age of 50.56 years. While heart failure can occur in any age group, it is more prevalent in older adults and is commonly caused by hypertension and ischemic heart disease. In contrast, in younger patients, valvular heart disease and non-ischemic cardiomyopathy are more common causes of heart failure in our study based on the age distribution in your study, the majority of patients were in the middle-aged and older age groups, with the highest percentage being in the 51-60 age range The percentage of patients under 30 was low, which is expected since heart failure is less common in younger age groups similarly in another study by Elbadawi A et al. [9],also shows that higher percentage of participants above 60 age range. Our study included a total of 50 cases, out of which 66% were male and 34% were female the gender distribution showed that heart failure was more commonly observed in males than females. This finding is consistent with many other studies that have reported similar results. For instance, Felker et al. [10],also observed a higher proportion of men (68.3%) with heart failure than women (31.7%). Similarly, the Framingham heart study [11]found that men had a significantly higher incidence of heart failure than women across all ages, with an age-standardized sex ratio of 1.67. We also found that ischemic heart disease (IHD) was the most common cause of heart failure, followed by hypertensive heart disease, dilated cardiomyopathy (DCMP), rheumatic heart disease (RHD), myocarditis, alcoholic cardiomyopathy, and calcified valve aortic regurgitation. These results are consistent with other studies conducted by Rudresh et al. [12],Felker et al. [10],and Yahya Al-Najjar et al. [13], The prevalence of each etiology may vary depending on the population and the region, but IHD and hypertensive heart disease are commonly found to be the leading causes of heart failure globally. Heart failure is a major health concern in the Indian subcontinent, with leading causes being coronary artery disease, hypertension, diabetes, and valvular heart diseases. Hypertension accounts for 48% of cases, with dyslipidemia and obesity contributing to 42% and 35% of cases respectively. Smoking and alcohol consumption are also significant risk factors, with 28% and 16% of cases respectively being attributed to these habits. The prevalence of diabetes in HF patients was found to be 16%. Effective prevention and management strategies targeting these risk factors are necessary to reduce the burden of heart failure in the Indian population. The statement suggests that in the current study, the mean RDW values of 48.3 and 53.5 observed in Class III and IV HF patients indicate that altered RDW is a feature of advanced heart disease. In comparison, in the study by author A. Krishnamoorthy[14], the mean RDW values of 50.24 and 62.48 observed in Class III and IV HF patients also indicate that altered RDW is a feature of advanced heart

disease. Our study found that a low EF of <50 was observed in 52% of the patients and EF (EF ≥ 50%) - 48%. In comparison, the other study done by Amareshwara J et al. [15],found that 70% of the heart failure patients had a reduced EF (EF <50%) and 30% had preserved EF (EF ≥ 50%). which suggests that RDW could potentially serve as a robust predictor of heart failure and a valuable indicator of prognostic outcomes. The findings strongly support the notion that alterations in RDW can be closely associated with heart failure, emphasizing the importance of further research in this area to explore its potential clinical utility. The limitation of our study is the small sample size.

CONCLUSION

Our study highlights that RDW, a component of the standard complete blood count, can be a reliable and cost-effective marker for evaluating heart failure (HF). Elevated RDW is associated with advanced stages of heart disease and correlates well with echocardiography findings in HF patients with reduced EF. The findings suggest that RDW can be utilized as an additional marker for the early diagnosis of suspected cases and monitoring their recovery. Further research is needed to understand the association between RDW and outcomes of cardiac failure.

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