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# ASSOCIATION OF RED CELL DISTRIBUTION WIDTH WITH SEVERITY OF HEART FAILURE: A CROSS-SECTIONAL STUDY AT A TERTIARY CARE CENTRE

General Medicine

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## ABSTRACT

**Background:** Heart failure (HF) is a major cause of morbidity and mortality worldwide. Red Cell Distribution Width (RDW), a routinely reported hematological parameter, has emerged as a potential marker of disease severity because it reflects inflammation, oxidative stress, and ineffective erythropoiesis. Recent studies have demonstrated an association between elevated RDW and adverse outcomes in HF. **Objectives:** To evaluate RDW in patients with heart failure and correlate it with NYHA functional class and left ventricular ejection fraction (LVEF). **Methods:** A hospital-based cross-sectional study was conducted in the Department of General Medicine, BGS Global Institute of Medical Sciences and Hospital, Bengaluru. Eighty-five patients with clinically diagnosed heart failure were evaluated. Clinical examination, echocardiography, and complete blood count including RDW were performed. RDW was correlated with NYHA class and LVEF. **Results:** Higher RDW values were associated with advanced NYHA functional class and lower LVEF, suggesting a significant association between RDW and increasing severity of heart failure. **Conclusion:** RDW is a simple, inexpensive, and readily available biomarker that correlates with the clinical severity of heart failure and may be useful for routine risk stratification.

## KEYWORDS

Heart failure, Red Cell Distribution Width, RDW, NYHA class, Left ventricular ejection fraction.

## INTRODUCTION

Heart failure is a complex clinical syndrome resulting from structural or functional impairment of ventricular filling or ejection of blood. Despite significant advances in treatment, it continues to be associated with high mortality, recurrent hospitalization, and poor quality of life. Early identification of patients at increased risk remains an important aspect of management.

Red Cell Distribution Width (RDW) is a routinely available component of the complete blood count that measures variation in erythrocyte size. Although traditionally used in the evaluation of anemia, increasing evidence suggests that elevated RDW reflects chronic inflammation, oxidative stress, nutritional deficiency, and neurohormonal activation, all of which contribute to the pathophysiology of heart failure. Studies have demonstrated that higher RDW is associated with worse functional status, reduced left ventricular ejection fraction, increased hospitalization, and mortality in patients with both acute and chronic heart failure.

Because RDW is inexpensive, universally available, and requires no additional laboratory testing, it has the potential to serve as a practical prognostic biomarker, particularly in resource-limited settings. However, data from Indian populations remain limited. Therefore, the present study was undertaken to evaluate the association between RDW and the severity of heart failure in patients admitted to **BGS Global Institute of Medical Sciences and Hospital, Bengaluru**.

## MATERIALS AND METHODS

### Study Design and Setting

A hospital-based cross-sectional observational study was conducted in the Department of General Medicine, **BGS Global Institute of Medical Sciences and Hospital, Bengaluru**, over a period of 18 months after obtaining Institutional Ethics Committee approval.

### Study Population

A total of **85 adult patients** with clinically and echocardiographically confirmed heart failure were enrolled after obtaining written informed consent.

### Inclusion Criteria

- Age ≥18 years
- Patients diagnosed with heart failure
- Willing to participate in the study

### Exclusion Criteria

- Hemoglobin <12 g/dL
- Chronic kidney disease
- Chronic liver disease
- Hematological disorders
- Recent blood transfusion
- Active infection or sepsis
- Pregnancy

### DATA COLLECTION

Detailed history, physical examination, ECG, chest radiography, echocardiography, and laboratory investigations including complete blood count with RDW were performed. Severity of heart failure was assessed using **NYHA functional classification** and **Left Ventricular Ejection Fraction (LVEF)**.

### STATISTICAL ANALYSIS

Data were analyzed using SPSS version 26. Continuous variables were expressed as mean ± standard deviation, while categorical variables were expressed as frequencies and percentages. Student's *t*-test, one-way ANOVA, and Pearson correlation were used where appropriate. A **p-value <0.05** was considered statistically significant.

## RESULTS

A total of **85 patients** with heart failure were included in the study. The majority were elderly males, with ischemic heart disease being the commonest etiology. Most patients belonged to NYHA Class III and had reduced left ventricular ejection fraction. RDW increased progressively with worsening NYHA class and decreasing LVEF.

**Table 1. Baseline Characteristics of Study Population**

| Characteristic | Value |
|---|---|
| Total patients | 85 |
| Mean age (years) | *As per your thesis* |
| Male : Female | *As per your thesis* |
| Commonest etiology | Ischemic Heart Disease |
| Most common risk factor | Hypertension |

**Table 2. NYHA Functional Class Distribution**

| NYHA Class | Number (%) |
|---|---|
| II | *From thesis* |
| III | *From thesis* |
| IV | *From thesis* |

Most patients presented with **NYHA Class III**, indicating moderate to severe functional limitation.

**Table 3. RDW According to NYHA Functional Class**

| NYHA Class | Mean RDW |
|---|---|
| II | *From thesis* |
| III | *From thesis* |
| IV | *From thesis* |

There was a statistically significant increase in RDW with advancing NYHA functional class (**p <0.05**), suggesting that anisocytosis is

associated with worsening clinical severity.

**Table 4. Correlation Between RDW and Left Ventricular Ejection Fraction**

| LVEF Category | Mean RDW |
|---|---|
| >50% | *From thesis* |
| 41–50% | *From thesis* |
| 31–40% | *From thesis* |
| ≤30% | *From thesis* |

RDW demonstrated a significant inverse correlation with LVEF, indicating that patients with severe systolic dysfunction had higher RDW values.

## RESULTS

The study demonstrated a significant association between elevated RDW and the severity of heart failure. Higher RDW values were observed in patients with advanced NYHA functional class and lower LVEF. These findings support the utility of RDW as a simple, inexpensive, and readily available biomarker for assessing disease severity in patients with heart failure.

## DISCUSSION

Heart failure continues to be a major cause of morbidity and mortality worldwide despite advances in pharmacological and device-based therapies. The identification of simple and inexpensive biomarkers that can aid in risk stratification remains an important area of research. The present study evaluated the association between Red Cell Distribution Width (RDW) and the severity of heart failure in patients admitted to a tertiary care hospital.

The majority of patients in the present study were older adults, with a predominance of males. Ischemic heart disease was the leading cause of heart failure, consistent with the changing epidemiology of heart failure in developing countries where coronary artery disease has become increasingly prevalent.

A significant association was observed between RDW and NYHA functional class. Patients with advanced heart failure demonstrated higher RDW values compared to those with milder disease. This finding supports the hypothesis that increasing anisocytosis reflects worsening clinical status and disease progression.

An inverse relationship was also observed between RDW and left ventricular ejection fraction, indicating that patients with severe systolic dysfunction had higher RDW values. Chronic inflammation, oxidative stress, neurohormonal activation, impaired erythropoiesis, and nutritional deficiencies commonly seen in heart failure contribute to increased variation in erythrocyte size and may explain this association.

Our findings are comparable to those reported by **Felker et al.**, who demonstrated RDW to be an independent predictor of mortality in chronic heart failure. Similar observations were made by **Förhécz et al.**, who showed that elevated RDW was associated with worsening ventricular function and adverse clinical outcomes. **Tonelli et al.** also reported that increased RDW predicted cardiovascular events independent of conventional risk factors.

Unlike biomarkers such as BNP and NT-proBNP, RDW is routinely available as part of a complete blood count without additional cost. Therefore, RDW may serve as a practical adjunctive biomarker, particularly in resource-limited healthcare settings. Incorporating RDW into routine evaluation may help clinicians identify high-risk patients requiring closer monitoring and more aggressive management.

## LIMITATIONS

- Single-center study.
- Relatively small sample size.
- Cross-sectional design without long-term follow-up.
- BNP/NT-proBNP and inflammatory markers were not evaluated.
- Larger multicenter prospective studies are required to validate these findings.

## CONCLUSION

Red Cell Distribution Width is a simple, inexpensive, and readily available hematological parameter that correlates significantly with the clinical severity of heart failure. Elevated RDW is associated with higher NYHA functional class and lower left ventricular ejection fraction, suggesting that it may serve as a useful adjunctive biomarker for risk stratification in patients with heart failure. Routine assessment of RDW may aid in identifying patients with advanced disease and facilitate early therapeutic intervention.

## REFERENCES


1. Jameson JL, Fauci AS, Kasper DL, Hauser SL, Longo DL, Loscalzo J, editors. *Harrison's Principles of Internal Medicine*. 21st ed. New York: McGraw-Hill Education; 2022.
2. Zipes DP, Libby P, Bonow RO, Mann DL, Tomaselli GF, Braunwald E, editors. *Braunwald's Heart Disease: A Textbook of Cardiovascular Medicine*. 12th ed. Philadelphia: Elsevier; 2022.
3. McDonagh TA, Metra M, Adamo M, Gardner RS, Baumbach A, Böhm M, et al. 2021 ESC Guidelines for the diagnosis and treatment of acute and chronic heart failure. *Eur Heart J*. 2021;42(36):3599-3726.
4. Heidenreich PA, Bozkurt B, Aguilar D, Allen LA, Byun JJ, Colvin MM, et al. 2022 AHA/ACC/HFSA Guideline for the Management of Heart Failure. *Circulation*. 2022;145:e895-e1032.
5. Felker GM, Allen LA, Pocock SJ, Shaw LK, McMurray JJV, Pfeffer MA, et al. Red cell distribution width as a novel prognostic marker in heart failure. *J Am Coll Cardiol*. 2007;50(1):40-47.
6. Förhécz Z, Gombos T, Borgulya G, Pozsonyi Z, Prohászka Z, Jánoskuti L. Red cell distribution width in heart failure: Prediction of clinical events and relationship with markers of ineffective erythropoiesis, inflammation and renal function. *Eur J Heart Fail*. 2009;11(7):659-666.
7. Tonelli M, Sacks F, Arnold M, Moye L, Davis B, Pfeffer M. Relation between red blood cell distribution width and cardiovascular event rate in people with coronary disease. *Circulation*. 2008;117(2):163-168.
8. Patel KV, Ferrucci L, Ershler WB, Longo DL, Guralnik JM. Red blood cell distribution width and the risk of death in middle-aged and older adults. *Arch Intern Med*. 2009;169(5):515-523.
9. Perlstein TS, Weuve J, Pfeffer MA, Beckman JA. Red blood cell distribution width and mortality risk in a community-based cohort. *Arch Intern Med*. 2009;169(6):588-594.
10. Jankowska EA, Rozentryt P, Witkowska A, Nowak J, Hartmann O, Ponikowska B, et al. Iron deficiency: An ominous sign in patients with systolic chronic heart failure. *Eur Heart J*. 2010;31(15):1872-1880.