https://doi.org/10.29309/TPMJ/2022.29.04.6761

The Professional Medical Journal
www.theprofesional.com
2022, Volume, 29 Issue, 04

ORIGINAL ARTICLE

Association between elevated red cell distribution width and in-hospital mortality in patients with acute decompensated heart failure.

Muhammad Asim Saddique[1], Asif Manzoor[2], Shahid Abbas[3], Hassan Asghar Randhawa[4]

Article Citation: Saddique MA, Manzoor A, Abbas S, Randhawa HA. Association between elevated red cell distribution width and in-hospital mortality in patients with acute decompensated heart failure. Professional Med J 2022; 29(4):521-526. https://doi.org/10.29309/TPMJ/2022.29.04.6761

ABSTRACT… Objective: To determine the frequency of death ratio in hospitalized patients has acute decompensated heart failure (ADHF) with elevated red cell distribution width (RDW). **Study Design:** Descriptive Cross-sectional Analysis. **Setting:** Armed Forces Institute of Cardiology/National Institute of Heart Diseases, (AFIC/NIH) Rawalpindi. **Period:** January, 2019 to July, 2019. **Material & Methods:** A total of one hundred and seventy five (n=175) patients of either gender between age 30-80 years who presented with ADHF with RDW ≥ 15.3% were enrolled. All patients were given standard care and were observed for mortality during their stay in the hospital. **Results:** Results of the present study showed 10.3% (n=18/175) patients died during their stay in the hospital. No significant difference was noted in mortality when data was stratified for age, gender and co-morbidities (P>0.05 in all cases). **Conclusion:** A significant proportion of patients presented with ADHF with an elevated RDW (>15.3%) were died during their stay in hospital. We suggest further randomized controlled trials to accurately evaluate the predictive role of RDW in these patients.

Key words: Heart Failure, Morbidity, Red Cell Distribution Width.

INTRODUCTION

Heart failure is a clinical syndrome posing significant economic impact and is found to have affected 26 million people across the globe with an increased mortality and hospital readmission rate.[1] Acute decompensated failure is known to be the main cause of hospital stay in Europe and United states with over 1 million annual hospitalizations, accounting for 1-2% of all hospitalizations.[2]

Numerous conditions are interlinked with increased heterogeneity of the volume of erythrocyte; such as oxidative stress, inflammation, ageing and insufficient dietary intake; might be at the same time all these factors are present in patients with HF, which plays a biological interaction between cardiac dysfunction and hematopoietic impairment.[3] The RDW might be non-expensive, rapid, and simple hematological parameter, imitating the degree of anisocytosis in-vivo. Recent investigation has reported that RDW valuation may predict the hazard of adverse outcomes in patients with acute and chronic HF.[4,5,6]

Kim et al., evaluated that, whether elevated RDW at admission; upsurges the ratio of mortality especially in older cardiac patients in emergency department. They found that in-hospital mortality frequency was about more than 3.5% and RDW ranges were greater in non-survivors than in survivors (15.9 ± 2.5 verses 13.8 ± 1.7 and represent p < 0.001 significant difference).[7] Uemura et al., has reported that variations in RDW range in hospital stay in-dependently predict non-significant outcomes in acute HF patients.[8] A recent investigational approach has reported by Sotiropoulos et al., assessed that association between mortality in acute HF patients with elevated RDW and reduced ejection fraction; this research analysis has done on approximately178

1. MBBS, MD, Consultant Cardiology, Niazi Medical and Dental College, Sargodha.
2. MBBS, MD, FCPS, Registrar Cardiology, AFIC/NIHD Rawalpindi.
3. MBBS, FCPS, Associate Professor Cardiology, Faisalabad Institute of Cardiology, Faisalabad.
4. MBBS, MD, Senior Registrar Cardiology, Faisalabad Institute of Cardiology, Faisalabad.

Correspondence Address:
Dr. Muhammad Asim Saddique
Department of Cardiology
Niazi Medical and Dental College, Sargodha.
drasimsaddique@hotmail.com

Article received on: 20/08/2021
Accepted for publication: 28/10/2021

patients who demonstrated; RDW≥15.3 at the time admission and mortality rate more than 7.5% (n=14/178).[9]

It is evident in the recent literature that in patients with heart failure RDW has emerged as a marker for prognosis. However, to the best of our knowledge we did not find any study conducted at national and local level. Present study was planned to find out RDW as a new marker of prognosis may be used for the assessment outcomes in patients seeking admission for ADHF. Present study results if comes out to be significant, measurement of RDW may be recommended in all ADHF patients at the time of admission. This would help in triaging high risk patients who need more meticulous monitoring and management with a goal of reducing associated mortality in these patients.

MATERIAL & METHODS

It is a descriptive cross-sectional analysis/trial conducted at AFIC/NIH, Rawalpindi for Six months (9th January, 2019 to 8th July, 2019).

The sample size was deliberated by using sample size calculator approved by WHO (1.1) by keeping: Confidence Level: 95%, Anticipated Population 7.9%, Absolute Precision: 4%, Sample size calculated n = 175.

Non-probability, convenient sample technique was used.

Inclusion Criteria

1. Patients aged 30-80 years, of both genders presenting with ADHF.
2. Patients with RDW ≥ 15.3%.

Exclusion Criteria

Patients with acute coronary syndrome, clinical features of active infection (Fever, rigors, chills, etc.), cardiogenic shock in need of intensive care, documented H/O any autoimmune diseases, H/O of hematologic proliferative disease or documented H/O of neoplasia were not included.

Ethical clearance was obtained from hospital ethical committee before initiation of study (08-2018/MEC/AFIC/RWD). Those patients fulfilling study inclusion criteria were enrolled from the indoor department of Armed Forces Institute of Cardiology Rawalpindi. Written consent was obtained from all patients. The demographic and baseline patient characteristics of the enrolled patients were recorded. Specific laboratory tests were performed including complete blood picture. RDW was calculated as per formula given in operational definition. All patients were given standard of care and were observed for mortality during their stay in the hospital. All information was recorded on the prescribed Proforma.

Data was done with the help of SPSS software version 20. The continuous numerical variables like age and RDW were described as mean ± SD. Categorical variables like gender, baseline co-morbidities (hypertension, diabetes and hyperlipidemia) and in-hospital mortality were presented as frequency and percentage. Effect modifiers like age, gender and co-morbidities (hypertension, diabetes and hyperlipidemia) were stratified. Post stratification chi-square test was applied and P ≤ 0.05 was deliberated as significant.

RESULTS

A total of one hundred and seventy five (n=175) patients of either gender between ages 30-80 years who presented with ADHF and RDW ≥ 15.3% were enrolled. All patients were given standard care and were observed for mortality during their stay in the hospital. Mean RDW in study sample is presented in Table-II.

		Frequency	Percentage
Gender	Males	125	71.4
	Females	50	28.6
Age Groups	30-60 y	72	41.1
	61-80 y	103	58.9
	Mean±SD	63.1± 8.5	
Hypertension	Present	138	78.9
	Absent	37	21.1
Diabetes	Present	112	64.0
	Absent	63	36.0
Hyper-lipidemia	Present	77	44.0
	Absent	98	56.0

Table-I. Basic demographic data and risk factors of the study groups.

Gender	Mean RDW	Std. Deviation
Males	17.4	1.7
Females	16.8	1.2
Total	17.2	1.6

Table-II. Mean RDW in study sample.

Mortality	Frequency	Percent
PRESENT	18	10.3
ABSENT	157	89.7
TOTAL	175	100.0

Table-III. Mortality in study sample.

Results of the present study showed that 10.3% (n=18/175) patients died during their stay in the hospital (Table-III).

No significant difference was noted in in-hospital mortality when data was stratified for age (p=0.764, Table-IV), gender (p=0.238, Table-IV), hypertension (p=0.623, Table-IV), diabetes (p=0.443, Table-IV) and hyperlipidemia (p=0.968, Table-IV).

Risk Factors stratification		Mortality			P-Value chi-Square
		Present	Absent	Total	
Age group	30-60Y	8(11.1%)	64(88.9%)	72(100.0%)	0.764
	61-80Y	10(10.3%)	93(90.3%)	103(100.0%)	
	Total	18(10.3%)	157(89.7%)	175(100.0%)	
Gender	Male	15(12.0%)	110(88.0%)	125(100.0)	0.238
	Female	3(6.0%)	47(94.0%)	50(100.0%)	
	Total	18(10.3%)	157(89.7%)	175(100.0%)	
Hypertension	Present	15(10.9%)	123(89.1%)	138(100.0%)	0.623
	Absent	3(8.1%)	34(91.9%)	37(100.0%)	
	Total	18(10.3%)	157(89.7%)	175(100.0%)	
Diabetes	Present	13(11.6%)	99(88.4%)	112(100.0%)	0.443
	Absent	5(7.9%)	58(92.1%)	63(100.0%)	
	Total	18(10.3%)	157(89.7%)	175(100.0%)	
Hyperlipidemia	Present	8(10.4%)	69(89.6%)	77(100.0%)	0.968
	Absent	10(10.2%)	88(89.8%)	98(100.0%)	
	Total	18(10.3%)	157(89.7%)	175(100.0%)	

Table-IV.

DISCUSSION

The RDW could be a non-expensive, rapid and simple hematologic parameter, reflective of the degree of anisocytosis in-vivo. The presently accessible technical proof recommends that RDW valuation mainly predicts the adverse outcomes in patients with acute and chronic decompensated HF.[10] Despite it remains unclear whether or not RDW may be a real risk issue or any byproduct in ADHF, preliminary results recommend that additional aggressive management could also be sensible in ADHF patients with increasing anisocytosis throughout the primary days of hospitalization. Concerning the biological interaction between impaired organic process and viscus pathology, several of the various conditions related to enhanced non-uniformity of the volume of red blood cells such as oxidative stress, insufficient dietary intake, age, inflammation and weakened/ compromised excretory organ function; could also be concurrently seen in patients with HF, while anisocytosis may contribute to worsen the cardiac activity. Our study was planned to search out RDW as a replacement marker of prognosis which will be used for the assessment of outcomes in patients seeking admission for acute decompensated failure (ADHF).[11] This will facilitate in triaging patients requiring additional meticulous observance and management with a goal of reducing associated mortality in these patients. 175 patients of either gender between age 30-80 years having acute decompensated

failure and red cell distribution dimension 15.3% were listed. All patients got commonplace care and were discovered for mortality throughout their keep within the hospital.

Our results showed that 10.3% (n=18/175) patients died during hospital stay. No vital distinction was noted in mortality once information was stratified for age, gender and co-morbidities (P>0.05 altogether cases). Our results were comparable to previous reported studies. A recent study, Sotiropoulos et al., observed that the association between elevated RBCs distribution and mortality rate in acute cardiac failure patients with reduced ejection fraction. There have been 178 patients having RWD > 15.3% at the time admission and mortality was more than 7.5% (n=14/178) in these patients during hospital stay.[9]

Another study has reported by Muhlestein JB; examined the prophetical ability of RDW and modification in RDW throughout hospital duration (Δ RDW) for length-of-stay (LOS) and one month outcomes once HF inmate keep. Their results showed that primary RDW and ΔRDW have related to mortality and extended LOS; the conclusion of this study showed that the initial RDW might aid in early prognosis and appropriate treatment.[12]

Huang YL et al., used scientific tools to calculate the impact of RDW on the prognosis of HF. They reviewed the association between RDW and HF outcomes either on admission or at discharge. They finally chose seventeen studies consisting of 18288 patients with HF. Their analysis unconcealed that RDW was one of the prognostic significance for HF patients.[13]

Uemura Y et al., determined the correlation among the changes in the values of RDW during hospitalization and long-term prognosis in patients with ADHF. RDW was calculated in about 229 patients with a history of ADHF. The results of this study showed that high level of RDW may increase the stay in hospital and also augment the frequency of mortality rate of ADHF patients as compared with patients have low levels of RDW during hospital stay.[8]

In our study, we have a tendency to take solely the RDW value at the period of hospital admission. We didn't measure any change within the RDW levels from baseline throughout hospitalization. Makhoul BF et al., studied the relation between baseline RDW and modifications in RDW throughout hospital-duration with clinical outcomes in ADHF patients; 614 numbers of patients with ADHF have prospectively studied and determined the baseline RDW and RDW modification throughout hospital-period/stay. Their results showed that throughout follow up of 1 year, 286(46.6%) patients died while 84 (13.7%) were readmitted for ADHF management, found that the Median RDW level; considerably higher in died patients as compared to survived patients (15.6% vs. 14.9%, P<0.0001).[14]

Study has proposed by Ferreira JP et al., retrospectively investigate the two independent cohorts; approximately 170 patients in the derivation-cohort; with age of (76.2±10.3 years) patients and 332 patients in validation-cohorts; with age of (76.4±12.2 years) patients have included. After 180 days of follow-up duration; in derivation cohort study, about 78 (45.9%) patients admitted in hospital have died due to HF/cardiovascular events. While, discharge RDW values showed significant linkage with adverse outcomes, discharge of RDW> 15% have shown 2-fold associated with adverse rate, HR=1.95 (1.05-3.62) and significant difference is P=0.04, whereas a ΔRDW >0 also had a strong relationship with adverse consequence, HR=2.47 (1.35-4.51) and significant difference is P=0.003. Authors concluded that variables of RDW may improve the risk stratification of ADHF patients on top of well-established prognostic markers.[15,16,17]

In summary, several studies in the literature proposed that RDW may aid as an important prognostic factor in ADHF patients. We obtained similar results in the present study. However, present study is purely observational in nature and we may not draw an inference. We suggest further studies in future comparing the mortality rate across different RDW values in ADHF patients. Moreover, change in RDW values during hospital stay may also be further evaluated in our

settings.

CONCLUSION

A significant proportion of patients presented with ADHF with an elevated RDW (>15.3%) were died during their stay in hospital.

REFERENCES

1. Ambrosy AP, Fonarow GC, Butler J, Chioncel O, Greene SJ, Vaduganathan M, et al. **The global health and economic burden of hospitalizations for heart failure: Lessons learned from hospitalized heart failure registries.** J Am Coll Cardiol. 2014; 63(12):1123-33.

2. Blecker S, Paul M, Taksler G, Ogedegbe G, Katz S. **Heart failure–associated hospitalizations in the United States.** J Am Coll Cardiol. 2013; 61(12):1259-67.

3. Lippi G, Turcato G, Cervellin G, Sanchis-Gomar F. **Red blood cell distribution width in heart failure: A narrative review.** World J Cardiol. 2018; 10(2):6–14.

4. Al-Kindi SG, Refaat M, Jayyousi A, Asaad N, Suwaid JA, Khalil CA, et al. **Red Cell Distribution Width Is Associated with All-Cause and Cardiovascular Mortality in Patients with Diabetes.** Biomed Res Int. 2017; 2017:5843702-3.

5. Xanthopoulos A, Giamouzis G, Melidonis A, Kitai T, Paraskevopoulou E, Paraskevopoulou P, et al. **Red blood cell distribution width as a prognostic marker in patients with heart failure and diabetes mellitus.** Cardiovas Diabetol. 2017; 16:81-4.

6. Tseliou E, Terrovitis JV, Kaldara EE, Talianis AS, Repasos E, Katsaros L, et al. **Red blood cell distribution width is a significant prognostic marker in advanced heart failure, independent of hemoglobin levels.** Hellenic J Cardiol. 2014; 55:457-61.

7. Kim SH, Yeon JH, Park KN, Oh SH, Choi SP, Kim YM, et al. **The association of Red cell distribution width and in-hospital mortality in older adults admitted to the emergency department.** Scand J Trauma Resusc Emerg Med. 2016; 24:81-5.

8. Uemura Y, Shibata R, Takemoto K, Uchikawa T, Koyasu M, Watanabe H, et al. **Elevation of red blood cell distribution width during hospitalization predicts mortality in patients with acute decompensated heart failure.** J Cardiol. 2016; 67:268–73.

9. Sotiropoulos K, Yerly P, Monney P, Garnier A, Regamey J, Hugli O, et al. **Red cell distribution width and mortality in acute heart failure patients with preserved and reduced ejection fraction.** ESC Heart Failure. 2016; 3:198–204.

10. Yu SB, Cui HY, Qin M, Liu T, Kong B, Zhao QY et al. **Impact of red cell distribution width on outcome of 16 681 patients with chronic systolic heart failure.** ZhonghuaXinXue Guan Bing ZaZhi. 2012; 40(3):237-42.

11. Lippi G, Turcato G, Cervellin G, Gomar SF. **Red blood cell distribution width in heart failure: A narrative review.** World J Cardiol. 2018; 10(2):6-14.

12. Muhlestein JB, Lappe DL, Anderson JL, Muhlestein JB, Budge D, May HT et al. **Both initial red cell distribution width (RDW) and change in RDW during heart failure hospitalization are associated with length of hospital stay and 30-day outcomes.** Int J Lab Hematol. 2016; 38(3):328-37.

13. Huang YL, Hu ZD, Liu SJ, Sun Y, Qin Q, Qin BD et al. **Prognostic value of red blood cell distribution width for patients with heart failure: A systematic review and meta-analysis of cohort studies.** PLoS One. 2014; 9(8):e104861-2.

14. Makhoul BF, Khourieh A, Kaplan M, Bahouth F, Aronson D, Azzam ZS et al. **Relation between changes in red cell distribution width and clinical outcomes in acute decompensated heart failure.** Int J Cardiol 2013; 167:1412–6.

15. Oh J, Kang SM, Won H, Hong N, Kim SY, Park S et al. **Prognostic value of change in red cell distribution width 1 month after discharge in acute decompensated heart failure patients.** Circ J. 2012; 76(1):109-16.

16. Turcato G, Zorzi E, Prati D, Ricci G, Bonora A, Zannoni M et al. **Early in-hospital variation of red blood cell distribution width predicts mortality in patients with acute heart failure.** Int J Cardiol. 2017; 243:306-10.

17. Ferreira JP, Girerd N, Arrigo M, Medeiros PB, Ricardo MB, Almeida T et al. **Enlarging red blood cell distribution width during hospitalization identifies a very high-risk subset of acutely decompensated heart failure patients and adds valuable prognostic information on top of hemoconcentration medicine (Baltimore).** 2016; 95(14):e3307-9.

AUTHORSHIP AND CONTRIBUTION DECLARATION

No.	Author(s) Full Name	Contribution to the paper	Author(s) Signature
1	Muhammad Asim Saddique	Discussion writing.	
2	Asif Manzoor	Manuscript writing and Data Collection.	
3	Shahid Abbas	Data Analysis and Critical Analysis.	
4	Hassan Asghar Randhawa	Abstract Writing.	