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FREQUENCY OF RAISED RED BLOOD CELL DISTRIBUTION WIDTH IN PATIENTS WITH HEART FAILURE

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ABSTRACT

BACKGROUND: Heart failure occurs when the ability to pump blood decreases causing accumulation of fluid in the lungs, lower limbs, abdomen and other parts of the body which leads to the symptoms of dyspnoea and generalized swelling in the body. In reduced ejection fraction heart failure, the ejection fraction of heart becomes less than 50% on echocardiography. The cause may be due to dilation of the cardiac chambers, ischemia or hypertrophy etc.
Since last decade studies have indicated that increased red blood cell distribution width (RDW) is associated with adverse outcomes in heart failure as well as with the development of heart failure.

OBJECTIVE: To determine frequency of raised red blood cell distribution width in patients with reduced ejection fraction heart failure.

METHODOLOGY: This cross sectional study was conducted in the department of Cardiology, MTI-Hayatabad Medical Complex, Peshawar from 14 May, 2020 to 14 Nov, 2020. Nonprobability consecutive sampling technique was used. Patients from both genders, admitted in the cardiology department were included according to inclusion and exclusion criteria. Informed consent was taken before the start of data collection and all pros and cons were explained to the patient or to next of kin.

RESULTS: A total of 196 patients were observed. Mean age of the patients was 57.22$\pm$5.53 years. Majority of patients were in 51-70 years age group. Number of male patients was greater 149 (76%) than female patients 47 (24%). Out of total patients, 50.5% had increased RDW. Increased RDW was stratified according to age, gender, Hb level and duration of heart failure.

CONCLUSION: Prevalence of RDW in HF with reduced ejection suggests that RDW may help in risk stratification of patients at the time of admission.

KEYWORDS: Heart failure, raised red blood cell distribution width, ejection fraction.

INTRODUCTION

The prevalence of heart failure in many countries is 4.7-13.3%[1]. Only in the USA about 870000 people are affected by heart failure each year[2]. In other developed countries like Korea and Japan the prevalence is 1.53%[3] while in Japan it is 0.8% of total population[4]. The prevalence is much higher in South Asia[5]. In a study it has been shown that 145 million dollars were spent for the treatment of patients with heart failure in Pakistan in 2012[6].

The mortality from heart failure has been reported as high as 31%[7]. One of the predictor of mortality is red blood cell distribution width (RDW). In a study it has been shown that RDW is a significant marker for adverse outcomes (p=0.007, HR: 1.14, CI: 1.04-1.24) and retained its prognostic significance even when corrected for Hb values (HR: 1.15, CI: 1.05-1.27, p=0.003)[8]. Another study also showed that higher RDW values in acute CHF patients at admission were associated with worse short- and long-term outcomes like in hospital mortality (P=0.044). RDW values had more prognostic value than Hb levels[9]. In a study Aung et al. showed that the frequency of raised red blood cell distribution width was found in 51% of patient with heart failure[10].

This study aimed to find out the frequency of increased red blood cells distribution width in patients with reduced ejection fraction heart failure. Till now no study has been conducted recently in Pakistan and especially in Peshawar.

METHODOLOGY

This was a cross sectional study carried out at the department of Cardiology, MTI-Hayatabad Medical Complex, Peshawar from 14 May, 2020 to 14 Nov, 2020. A non-probability consecutive sampling technique was used. All patients from both the genders admitted in the cardiology department were included in the study. Informed consent was taken before the start of data collection and all pros and cons were explained to the patients or to their relatives. Blood samples for haemoglobin, and RDW estimation were analysed in pathology laboratory of Hayatabad Medical Complex. Echocardiography of each patient was done. The duration of heart failure since the first hospitalization for heart failure was noted in the proforma. The patients were treated before the start of the data collection as per hospital protocol. All the data like age, gender, ejection fraction, haemoglobin level, BMI, duration of heart failure and RDW as per operational definitions were collected and noted in proforma.

Sample size:

The frequency of raised red blood cell distribution width in heart failure patient is 51% [10]. With 7% of margin of error and 95% confidence interval the sample size was n= **196** patients with reduced ejection fraction heart failure.

Inclusion criteria:

All patients of age 30-70 years and from both genders who presented with complains of shortness of breath and exertion diagnosed for reduced ejection fraction heart failure for the last one year presenting to cardiology departments of Hayatabad Medical Complex, Peshawar.

Exclusion criteria:

All those patients with acute or chronic kidney failure (previous record of chronic kidney disease or with creatinine more than 1.5mg/dl) or chronic liver disease were excluded from the study.

Similarly patients with previous known haematological malignancy or other cancer or on chemotherapy or radiotherapy were excluded. Patients with kknown any type of cardiac valvular abnormality were also excluded from study.

Data Analysis:

Statistical analysis was done by using SPSS version 22 (IBM SPSS 23). Mean and standard deviations of continuous variables like age, ejection fraction, haemoglobin level, RDW were calculated. Frequency and percentages were calculated for categorical variables like gender and presence of increase RDW. Effect modifiers like age, gender, haemoglobin level, BMI and duration of heart

failure were stratified against the presence of increased RDW. Chi square test was applied for the categorical variables and a p value of ≤0.05 was taken significant. All the data were presented using tables and graphs.

RESULTS

The study included a total of 196 patients. Mean age of the patients was 57.22±5.53 years, mean BMI was 26.81±1.30 kg/m^2, mean ejection fraction was 43.10±4.06 and mean Hb level was 14.71±1.23 gm/dl. On gender distribution, 149 (76%) patients were males while 47 (24%) were females. Out of 196 patients, 24 (12.2%) were in the age group 30-50 years while 172 (87.8%) were in age group 51-70 years.

Out of 196 patients, 99 (50.5%) patients had increased RDW.

Table No. 1: Frequencies and Percentages for Increased RDW (n=196)

Increased RDW	Frequency	Percent
Yes	99	50.5%
No	97	49.5%
Total	196	100.0%

Out of 99 patients who had increased RDW, 85 were in age group 51-70 years while 14 patients were in 30-50 years category.

Table No. 2: Stratification of Increased RDW with Age Groups (n=196)

		Age Groups		Total	P Value
		30-50 Years	51-70 Years		
Increased RDW	Yes	14 (58.3%)	85 (49.4%)	99 (50.5%)	0.413
	No	10 (41.7%)	87 (50.6%)	97 (49.5%)	
Total		24 (12.24%)	172 (87.7%)	196 (100%)	

On gender wise distribution, RDW was more in males as compared to females without any statistical significant difference.

Table No. 3: Stratification of Increased RDW with Gender Groups (n=196)

		Gender		Total	P Value
		Male	Female		
Increased RDW	Yes	73 (49.0%)	26 (55.3%)	99 (50.5%)	0.449
	No	76 (51.0%)	21 (44.7%)	97 (49.5%)	
Total		149 (76.02)	47 (23.97%)	196 (100%)	

According to hemoglobin categories, stratification of RDW showed that majority of patients above 15.5 gm/dl showed increased RDW while majority of patients in < 15.5 gm/dl category showed no increase in RDW.

Table No 4: Stratification of increased RDW with Hb level (n=196)

		Hb Level		Total	P Value
		≤ 15.5 gm/dl	> 15.5 gm/dl		
Increased RDW	Yes	19 (19.2%)	80 (80.2%)	99 (50.5%)	<0.001
	No	91 (93.8%)	6 (6.8%)	97 (49.5%)	
Total		110 (56.1%)	86 (43.9%)	196 (100%)	

DISCUSSION

Heart failure occurs when the ability to pump blood decreases causing accommodation of fluid in the lungs, lower limbs, abdomen and other parts of the body which leads to the symptom of dyspnoea and swellings. In reduced ejection fraction heart failure, the ejection fraction of heart become less

than 50% on echocardiography. It may be due to dilation of the cardiac chambers, ischemia or hypertrophy etc.

The prevalence of heart failure in many countries are from 4.7-13.3%[1]. Only in the USA about 870000 people are affecting by heart failure each year[2]. In other developed countries like Korea and Japan the prevalence was 1.53%[3] while in Japan it was 0.8% of total population[4]. The prevalence is much higher in South Asia[5]. In a study it has been shown that 145 million dollars are spend on the cost of heart failure in Pakistan in 2012[6].

The mortality from heart has been reported as high as 31%[7]. One of the predictor of mortality is red blood cell distribution width (RDW). In a study it has been shown that RDW is a significant marker for adverse prognosis (p=0.007, HR: 1.14, CI: 1.04-1.24) and retained its prognostic significance even when corrected for Hb values (HR: 1.15, CI: 1.05-1.27, p=0.003)[8]. Another study also showed that higher RDW values in acute CHF patients at admission were associated with worse short- and long-term outcomes like in hospital mortality (P=0.044)and RDW values were more prognostically relevant than Hb levels[9]. In one study Aung et al. showed that the frequency of raised red blood cell distribution width is in 51% of patient with heart failure10 which was in consistency with the findings of this study 99 (50.5%) patients from had increased RDW.

In the general population, RDW increases with conditions of ineffective red cell production (such as iron deficiency, folate or B12 deficiency, and hemoglobinopathy), increased red cell destruction, or after blood transfusion. Anaemia is a strong predictor of mortality in heart failure suggesting that RDW is a strong predictor for mortality and morbidity[8, 10, 11] because of the high prevalence of anaemia.[8] In fact, some heart failure studies link elevated RDW with inflammation, malnutrition, and renal dysfunction that may all impact on erythropoiesis.[12, 13] However, results from the CHARM North America study cohort ($n = 2697$) indicate a prognostic role of RDW that is independent from haemoglobin level based on the observation that both parameters were retained in the final model for prediction of ACM but without reciprocal interaction.[8] This observation was replicated in the Duke Databank cohort providing supportive evidence.[8]Additional evidence for a distinct role of RDW derives from the European Prospective Investigation into Cancer and Nutrition (EPIC) Norfolk study and the Malmö Cancer and Diet study which show an association of RDW with incident heart failure while RDW was in this middle-aged healthy population without relation to iron metabolism or inflammation.[14, 15]

In the present study, evidence based pharmacological treatment was increased in the majority of patients with reduced LVEF <50% during hospitalization (inhibitors of the renin–angiotensin system: 70% to 92%; β-blocker treatment: 35 to 58%; antagonists of the mineralocorticoid receptor: 21 to 38%). It is well known that increase of pharmacological HF treatment improves 1-year survival;[6, 13] therefore, mortality difference between the RDW quartiles in the present study may have decreased because of improved drug therapy; second, more patients with preserved LVEF and low RDW had developed AHF because of hypertensive crisis. Hypertensive crisis is associated with a low mortality[16] suggesting accentuation of the mortality difference between low and high RDW quartiles; third, recent results from the Swedish Heart failure registry suggest that β-blocker treatment reduces ACM in HF patients with preserved LVEF.[17] Finally, being the single centre study design represents its limitations.

CONCLUSION

Prevalence of RDW in HF with reduced ejection suggests that RDW may help to stratify risks at the time of admission. In addition, the results of this study merit further workup of the interaction of RDW in HF patients with preserved ejection fraction, and thus, increase our understanding of clinically relevant pathophysiology in these patients.

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