

Anemia with Red Cell Indices among Patients Suffering from Chronic Cardiac Failure Admitted at Tertiary Care Hospital

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ABSTRACT

Background: Chronic heart failure (CHF), is a progressive condition characterized by the heart's inability to effectively pump blood throughout the body. It is a leading contributor to mortality globally, presenting substantial difficulties in clinical care. Anemia, commonly coexists with chronic cardiac failure and is associated with poorer outcomes and increased mortality rates. Additionally, abnormalities in red blood cell (RBC) indices further complicate the clinical picture, posing challenges in diagnosis and management. **Objective:** To determine the relationship between the severity of chronic cardiac failure and the severity of anemia, as evidenced by abnormalities in red cell indices. **Study Design:** Prospective observational study. **Settings:** Cardiology department of peoples University of Medical and health Sciences, Nawab Shah Pakistan. **Duration:** Six months from January 2022 to June 2022. **Methods:** Patients aged 18 years or old, both gender and diagnosed as the cases of chronic heart failure were included. Chronic heart failure was classified to categorize the severity of heart failure based on the level of symptoms and limitations experienced by the patient during physical activities. A 5ml blood sample was obtained from each participant via venipuncture and collected in a tube for complete blood count (CBC) tests. All the information was entered and analyzed using SPSS version 26. **Results:** A total of 109 patients of chronic heart failure were studied with an overall average age of 61.44±14.28 years. Males were 57.8% and females were 42.2%. Frequency of anemia was 47.7% in chronic heart failure patients, while statistically insignificant according to severity of HF (p=0.202). Average hemoglobin (HB) levels for heart failure (HF) classifications class I - class IV were 14.45 g/dl, 12.41 g/dl, 11.82 g/dl, and 11.30 g/dl, respectively. Furthermore, p-values indicated the statistical insignificance of the observed variations between HF classifications for each parameter (p>0.05). **Conclusion:** Anemia among patients of chronic heart failure found to be the highly frequent 47.7%. The average levels of hemoglobin and red blood cell indices showed no significant variation across different severities of chronic heart failure.

Keywords: Chronic heart failure, Anemia, RBC, MCV, MCH, MCHC.

INTRODUCTION

Chronic heart failure (CHF) represents the advanced phase of various heart conditions, characterized by increased rates of illness and death.¹ Due to its serious potential complications and widespread occurrence, CHF poses a significant health issue, leading to substantial

economic burden in both developed and developing nations. It is viewed as a global health crisis, impacting approximately 64 million individuals worldwide.^{2,3} It is anticipated that the prevalence of HF will rise due to population aging. Recent forecasts for the United States indicate a projected increase of around 46% in HF

prevalence from 2012 to 2030, accompanied by a corresponding surge in healthcare expenses.^{2,4} Heart failure (HF) is linked with significant rises in illness, death, reduced quality of life, and imposes a significant economic burden on national healthcare system.^{5,6} In low- and middle-income countries (LMICs), existing data indicate that heart failure (HF) is correlated with elevated rates of illness and death, extended hospital stays, and therefore, imposes a substantial burden of the society.⁵ The rising challenge of heart failure (HF) in lower and the middle income nations is propelled by a shift in disease patterns and a rise in the occurrence of contributing factors like diabetes mellitus, high blood pressure, lipid levels abnormalities in the blood, or obesity. Lifestyle changes, including reduced physical activity, heightened alcohol consumption, and smoking, further exacerbate this trend.

Anemia is frequently observed in individuals suffering from CHF and has been suggested as a new focus for treatment in this group of patients. The prevalence estimates for anemia among individuals having CHF and decreased ejection fraction vary considerably, ranging from 4% to 61%.^{7,8} Iron deficiency (ID) has conventionally been recognized as a causative factor of anemia. In routine clinical settings, hemoglobin levels and automatically measured red cell indices (RCI) are commonly regarded as sensitive markers of overall iron status.⁹ It has been observed that the parameters associated to the red blood cells, such as hemoglobin, hematocrit, mean corpuscular volume (MCV), and red cell distribution width (RDW), are important in forecasting the prognosis of heart failure.¹⁰ In heart failure, elevated levels of RDW and MCV are observed. Increased RDW levels are associated with more pronounced left ventricular dysfunction.¹⁰ Under typical circumstances, about 1% of red blood cells (RBCs) are generated daily, yet RBC production can notably escalate during periods of acute or chronic stress.^{11,12} However, in individuals with cardiovascular risk factors, the mechanical characteristics and lipid composition of RBCs undergo changes, leading to diminished tissue perfusion, heightened oxidative stress, decreased oxygen supply, and a rise in whole blood viscosity. These alterations may contribute to heightened cardiovascular mortality.^{11,13} Limited research has been conducted on the association between anemia and red cell indices abnormalities in chronic cardiac failure, particularly at the local level. This lack of attention to this specific area in previous studies underscores the need for further investigation. Understanding this association carries substantial clinical implications, potentially aiding in the identification of high-risk patients and facilitating the implementation of more tailored interventions, which may decrease morbidity and mortality.

METHODS

This prospective observational study was conducted at cardiology department of Peoples University of Medical and Health Sciences. Study was done during six months from January 2022 to June 2022. All the patients aged 18 years or old, both gender and diagnosed as the cases of chronic heart failure were included. Patients with acute heart failure, active bleeding disorders, patients with known hematological disorders and those who were unwilling or unable to participate in the study were excluded. Before enrolling in the study, eligible participants received thorough counseling regarding the study's aims and objectives and procedures including potential risks, and benefits. Informed consent was obtained voluntarily from all participants. Chronic heart failure was classified using a system of classes, to categorize the severity of heart failure based on the level of symptoms and limitations experienced by the patient during physical activity. Class I; patients with no limitations in physical activity, where ordinary exertion does not trigger heart failure symptoms. In Class II, patients experience slight limitations during physical activity, although they remain comfortable at rest. However, ordinary activities may result in heart failure symptoms. Class III; patients with marked limitations in physical activity; they are comfortable at rest, but even mild exertion can provoke symptoms. In Class IV, patients are unable to engage in any physical activity without discomfort, experiencing symptoms even at rest, with any exertion exacerbating their condition. Medical records of eligible participants were reviewed to gather demographic information, medical history, medication usage, and laboratory test findings. A 5ml blood sample was obtained from each participant via venipuncture and collected in a tube for complete blood count (CBC) tests. These tests assessed hemoglobin levels and included measurements of red cell indices such as hemoglobin concentration, hematocrit, MCV, MCH, MCHC, and RDW. All the information was entered and analyzed using SPSS version 26.

RESULTS

A total of 109 patients of chronic heart failure were studied with an overall mean age of 61.44 ± 14.28 years. Males were 57.8% and females were 42.2%. Among the 109 patients analyzed, the distribution across the four NYHA classes is as follows: Class I comprises 1.8%, Class II includes 32.1%, Class III consists of 29.4%, and Class IV comprises 36.7% of the total study participants. The mean hemoglobin level was 11.87 g/dl, with a standard deviation of 2.50, while the average hematocrit percentage was 36.77%, with a standard deviation of 9.51. The mean RBC count was 4.56 m/cmm, with a standard deviation of 0.84. The average MCV was 80.43 FL, and the mean MCH was 26.89 pg/dl. Additionally, the mean

MCHC was 33.0 g/dl, and the average RDW-CV% was 14.46%. (Table 1)

Table 1: HF-NYHA classification and average hemoglobin and RBC indices n=109

Variables		Frequency	Percent
HF-NYHA classification	I	2	1.8
	II	35	32.1
	III	32	29.4
	IV	40	36.7
	Total	109	100.0
Mean ± Standard deviation			
Hemoglobin and RBCs indices	Hb	11.87±2.50	
	Hematocrit	36.77±9.51 %	
	RBC	4.56±0.84 m/cmm	
	MCV	80.43±7.75 FL	
	MCH	26.89±6.33 pg/dl	
	MCHC	33.0±5.06 g/dl	
	RDW	14.46±1.85 CV%	

In this study frequency of anemia was 47.7% in chronic heart failure patients, while statistically insignificant according to severity of HF (p=0.202). (Table 2)

Table 2. Frequency of anemia in chronic heart failure patients n=109

HF classification	Anemia		p-value
	Yes	No	
Class I	0	2	0.202
	0.0%	1.8%	
Class II	13	22	
	11.9%	20.2%	
Class III	17	15	
	15.6%	13.8%	
Class IV	22	18	
	20.2%	16.5%	
Total	52	57	
	47.7%	52.3%	

The average hemoglobin (HB) levels for heart failure (HF) classifications class I - class IV were 14.45 g/dl, 12.41 g/dl, 11.82 g/dl, and 11.30 g/dl, respectively. Mean hematocrit levels range from 45.05% for HF class I to 33.95% for HF class IV. This comparative trend extends to red blood cell (RBC) count, mean corpuscular volume (MCV), and mean corpuscular hemoglobin (MCH), suggesting differences in these parameters across distinct HF classifications. Furthermore, p-values indicated the statistical insignificance of the observed variations

between HF classifications for each parameter (p>0.05) as shown in table 3.

Table 3: Mean comparison of HB and RBCs indices according to HF classification n=109

HB and RBCs indices	HF-Classification	Mean	Std. D	P-value
HB	I	14.45	0.07	0.118
	II	12.41	2.55	
	III	11.82	2.38	
	IV	11.30	2.50	
Hematocrit (%)	I	45.05	1.76	0.086
	II	38.30	6.12	
	III	38.10	12.25	
	IV	33.95	9.11	
RBC m/cmm	I	5.13	0.13	0.488
	II	4.62	0.69	
	III	4.64	0.77	
	IV	4.42	1.02	
MCV FL	I	86.35	7.99	0.172
	II	81.96	4.63	
	III	78.28	8.81	
	IV	80.52	8.75	
MCH pg/dl	I	27.80	1.13	0.702
	II	27.65	2.74	
	III	25.84	3.52	
	IV	27.03	9.65	

DISCUSSION

Chronic heart failure (CHF) is a progressive disorder marked by the heart's incapacity to effectively pump blood to meet the body's requirements. Anemia is commonly found in people with heart failure and has been linked to increased risks of hospitalization, complications, and significant rates of the mortality. Rectifying this condition is crucial for enhancing the well-being and medical prognosis of affected individuals.¹⁴ This study aims to assess the correlation between the severity of chronic heart failure and the severity of anemia, as indicated by abnormalities in red blood cell indices. A total of 109 patients with chronic heart failure participated in the study, with an average age of 61.44 ± 14.28 years and the study population comprised 57.8% males and 42.2% females. These findings were correlated study by Khan Z *et al*¹⁵ as males were 60% and females were 40% with the overall average age of 54 years. However, Lawson CA *et al*¹⁶ reported that the 50% cases were females and overall mean age of the patients was 77.8 (11.7) years. Our findings were also supported by the Lainščak M *et al*¹⁶ median age for women was 69 years, while for men, it was 65 years and females were 28.5%.

This male dominance in heart failure patients may be attributed to various factors, including differences in lifestyle habits, such as smoking and alcohol consumption, which are more prevalent among men and can play a role in the onset and advancement of heart failure. Furthermore, hormonal differences between males and females, particularly the cardioprotective effects of estrogen in premenopausal women, may also play a role in the observed gender disparity.

In this study among the 109 patients analyzed, the distribution across the four NYHA classes is as follows: Class I comprises 1.8%, Class II includes 32.1%, Class III consists of 29.4%, and Class IV comprises 36.7% of the total study participants. In the comparison of this study Memon AG *et al*¹⁸ reported that the of patients across NYHA classes were as follows: Class II encompassed 451(46.9%) individuals, Class III comprised 317(33.0%) individuals, and Class IV consisted of 193(20.1%) individuals. Burchmore according of a previous study by Khan Z *et al*¹⁹ the majority of patients (45%) who came to the unit exhibited NYHA class III heart failure, while other classes statistics not mentioned clearly in their study.

In this study the frequency of anemia was 47.7% in chronic heart failure patients, while statistically insignificant according to severity of HF (p=0.202). This aligns with the findings of V *et al*,²⁰ who reported a similar prevalence of iron deficiency in about 50% of heart failure patients. However, Qasim M *et al*,²¹ observed a higher rate of anemia at 54.7% in heart failure patients. Another study by Iftexhar MF *et al*,²² indicated a lower prevalence of anemia in 29% of heart failure cases. Furthermore, in this study the average hemoglobin (HB) levels for heart failure (HF) classifications class I - class IV were 14.45 g/dl, 12.41 g/dl, 11.82 g/dl, and 11.30 g/dl, respectively. Mean hematocrit levels range from 45.05% for HF class I to 33.95% for HF class IV. This comparative trend extends to red blood cell (RBC) count, mean corpuscular volume (MCV), and mean corpuscular hemoglobin (MCH), suggesting differences in these parameters across distinct HF classifications. P-values indicated the statistical insignificant difference between HF classifications for each parameter (p>0.05). in the comparison of this study Murugan AC *et al*¹⁰ reported that the Red blood cell indices, including hemoglobin, packed cell volume (PCV), (MCV), and (RDW), are important indicators for predicting the prognosis of heart failure. Elevated levels of RDW and MCV are commonly observed in heart failure patients and higher RDW levels are associated with more pronounced left ventricular dysfunction.¹⁰ Furthermore Tkaczyszyn M *et al*⁹ indicated that the adverse effects of iron deficiency on the long-term outlook of patients with heart failure are somewhat separate from hematological irregularities, such as

reduced red cell indices. This study has notable strengths but also several limitations regarding red blood cell (RBC) indices. Firstly, we observed insignificant averages across the severity of heart failure (HF). This could be attributed to factors such as our sample selection method or the absence of a control group for comparison. Additionally, our study did not investigate outcomes in terms of mortality, which could provide valuable insights into the relationship between RBC indices and patient prognosis. Moving forward, it is imperative to conduct further large-scale studies, particularly employing case-control designs, to elucidate significant findings more comprehensively. By incorporating well-defined control groups and assessing mortality outcomes, future research can better discern the impact of RBC indices on the prognosis of chronic heart failure patients.

CONCLUSION

Anemia among patients of chronic heart failure found to be the highly frequent 47.7%. The average levels of hemoglobin and red blood cell indices showed no significant variation across different severities of chronic heart failure. These findings underscore the importance of routine screening for iron deficiency in patients with heart failure, regardless of the presence of anemia or abnormalities in red cell indices. The detrimental effects of iron deficiency on long-term survival in heart failure patients may be partly independent of red cell indices. Therefore, interventions aimed at addressing iron deficiency could potentially improve the prognosis and outcomes of individuals with heart failure.

LIMITATIONS

The study is limited by its small sample size and single-center nature, as well as the lack of a control group for comparison.

SUGGESTIONS / RECOMMENDATIONS

Further prospective studies with larger sample sizes and longitudinal follow-up, are recommended to better understand the implications of iron deficiency in chronic heart failure management and to optimize patient care strategies.

CONFLICT OF INTEREST / DISCLOSURE

None.

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