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Original Research Article

Role of anemia in the severity and outcome of chronic heart failure

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ABSTRACT

Background: Chronic heart failure is a major cause of morbidity and hospitalization worldwide. Anemia is frequently observed among heart failure patients and may worsen disease severity and clinical outcomes. However, limited data are available regarding this association in Bangladesh. This study aimed to evaluate the role of anemia in the severity and outcome of chronic heart failure.
Methods: This hospital-based observational study was conducted in the department of cardiology at Satkhira Medical College and Hospital from January 2025 to December 2025. A total of 180 patients with chronic heart failure were included. Data on demographic characteristics, anemia status, severity of heart failure according to New York Heart Association (NYHA) classification and clinical outcomes were collected using a structured data sheet.
Results: Among 180 patients with chronic heart failure, 107 (59.4%) had anemia. Most anemic patients had mild anemia (41.1%). Anemic patients were mainly in NYHA class III (43.0%) and IV (19.6%), whereas non-anemic patients were mostly in class II (38.4%) and I (23.3%). Significant differences were found for class I ($p<0.001$) and class III ($p=0.032$). Prolonged hospital stay was higher among anemic patients (40.2% vs. 23.3%, $p=0.018$), and clinical improvement was lower (57.0% versus 75.3%, $p=0.012$). Readmission and mortality were higher but not statistically significant.
Conclusions: Anemia is common among patients with chronic heart failure and is associated with greater disease severity and poorer clinical outcomes. Early identification and management of anemia may help improve the prognosis of heart failure patients.

Keywords: Anemia, Chronic heart failure, Clinical outcomes, NYHA classification

INTRODUCTION

Chronic Heart Failure is a major global health problem and represents one of the leading causes of morbidity, hospitalization and mortality worldwide.[1] It is characterized by the inability of the heart to pump sufficient blood to meet the metabolic demands of the body. The prevalence of chronic heart failure is increasing due to population aging, improved survival after acute cardiac events and the growing burden of cardiovascular risk factors such as hypertension, diabetes mellitus and ischemic heart disease.[2] In developing countries including Bangladesh, chronic heart failure has become an important public health concern and contributes significantly to healthcare expenditure and reduced quality of life.[3]

Anemia is a common comorbidity among patients with chronic heart failure and has been increasingly recognized as an important factor influencing disease progression and prognosis.[4] The prevalence of anemia in heart failure patients varies widely in different studies, ranging from approximately 20% to 60%. Several mechanisms contribute to the development of anemia in these patients, including chronic inflammation, nutritional deficiencies, renal dysfunction, reduced erythropoietin production and the effects of certain medications used in heart failure management.[5] In addition, hemodilution resulting from fluid retention may also contribute to reduced hemoglobin

concentration in patients with advanced heart failure.[6]

The presence of anemia in patients with chronic heart failure may significantly worsen clinical outcomes[7]. Reduced hemoglobin levels decrease the oxygen-carrying capacity of blood, which leads to impaired oxygen delivery to tissues and increased cardiac workload.[8] As a compensatory mechanism, the heart attempts to increase cardiac output, which may further aggravate myocardial stress and contribute to the progression of heart failure.[9] Consequently, patients with both anemia and heart failure often experience more severe symptoms, including fatigue, dyspnea, reduced exercise tolerance and decreased functional capacity.

Several clinical studies have demonstrated that anemia is associated with increased severity of heart failure, higher New York Heart Association (NYHA) functional class, prolonged hospital stay, higher rates of hospital readmission and increased mortality.[10] Early identification and appropriate management of anemia in heart failure patients may therefore play an important role in improving clinical outcomes and quality of life.[11] Despite growing evidence regarding the association between anemia and heart failure outcomes, data from developing countries, remain relatively limited.[12,13]

Understanding the relationship between anemia and the severity and outcome of chronic heart failure in the local population is essential for improving patient management strategies. Therefore, this study was conducted in the department of cardiology at Satkhira Medical College and Hospital to evaluate the role of anemia in determining the severity and clinical outcomes of patients with chronic heart failure. The findings of this study may help clinicians identify high-risk patients and develop appropriate therapeutic strategies to reduce complications and improve prognosis in patients suffering from chronic heart failure.

METHODS

This hospital-based observational study was conducted in the department of cardiology at Satkhira Medical College and Hospital, Bangladesh, from January 2025 to December 2025 to evaluate the role of anemia in the severity and outcome of patients with chronic heart failure. A total of 180 patients diagnosed with chronic heart failure were enrolled consecutively during the study period. Diagnosis of chronic heart failure was established based on clinical evaluation, echocardiographic findings and relevant laboratory investigations. Hemoglobin levels were measured for all participants and anemia was defined according to World Health Organization criteria. The severity of heart failure was assessed using the New York Heart Association (NYHA) functional classification. Data regarding demographic characteristics, clinical features, comorbidities, hemoglobin levels, NYHA class, duration of hospital stay, readmission and in-hospital outcome were collected using a structured data collection sheet from patient interviews, clinical examinations and hospital records.

Inclusion criteria included patients aged 18 years or older with a confirmed diagnosis of chronic heart failure who provided informed consent to participate in the study. Exclusion criteria included patients with acute heart failure, active bleeding, hematological malignancies, chronic liver disease, recent blood transfusion within the previous three months, pregnancy, or incomplete clinical records.

All collected data were checked, coded and entered into a computer for statistical analysis. Statistical analyses were performed using IBM SPSS Statistics version 25.0. Descriptive statistics such as frequency, percentage, mean and standard deviation were used to summarize the data. Associations between anemia status and severity of heart failure as well as clinical outcomes were analyzed using the Chi-square test or Fisher's exact test where appropriate. Continuous variables were compared using the independent sample t-test. A p value of less than 0.05 was considered statistically significant.

RESULTS

Table 1 presents the demographic characteristics of the 180 study participants. The majority of patients were aged 60-69 years (28.3%), followed by those aged 50-59 years (26.7%), while only 9.4% were below 40 years. Male patients predominated (57.8%) compared to females (42.2%). Regarding residence, most patients came from rural areas (62.2%), whereas 37.8% resided in urban locations.

Table 1: Demographic characteristics of the study population (n=180).

Variables	Frequency	Percentage
Age group (years)		
<40	17	9.4
40-49	29	16.1
50-59	48	26.7
60-69	51	28.3
≥70	35	19.5
Sex		
Male	104	57.8
Female	76	42.2
Residence		
Rural	112	62.2
Urban	68	37.8

Table 2 shows the distribution of patients according to anemia status. Among the 180 chronic heart failure patients, more than half- 107 individuals (59.4%)- were anemic, while 73 patients (40.6%) were non-anemic. Among the anemic subgroup, the majority had mild anemia (44 patients, 41.1%), followed by moderate anemia

(39 patients, 36.4%) and severe anemia (24 patients, 22.5%).

Table 2: Distribution of patients according to anemia status (n=180).

Anemia status	Frequency	Percentage
Anemic	107	59.4
Non-anemic	73	40.6
Severity of anemia (n=107)		
Mild	44	41.1
Moderate	39	36.4
Severe	24	22.5

Table 3: Association between anemia and severity of chronic heart failure (NYHA class) (n=180).

NYHA Class	Anemic (n=107) N (%)	Non-anemic (n=73) N (%)	P value
Class I	9 (8.4)	17 (23.3)	<0.001
Class II	31 (29.0)	28 (38.4)	0.190
Class III	46 (43.0)	20 (27.4)	0.032
Class IV	21 (19.6)	8 (11.0)	0.110

Table 3 demonstrates the association between anemia and the severity of chronic heart failure as assessed by NYHA functional class. Among anemic patients (n=107), the majority were in NYHA Class III (43.0%) and class IV (19.6%), whereas non-anemic patients (n=73) were predominantly in class II (38.4%) and class I (23.3%). The difference between anemic and non-anemic groups was statistically significant for NYHA class I (8.4% versus 23.3%, p<0.001) and class III (43.0% versus 27.4%, p=0.032). Although a higher proportion of anemic patients were in Class IV compared to non-anemic patients (19.6% versus 11.0%), this difference did not reach statistical significance (p=0.110). No significant difference was observed for class II (p=0.190).

Table 4: Clinical outcomes of chronic heart failure patients according to anemia status (n=180).

Outcome	Anemic (n=107) N (%)	Non-anemic (n=73) N (%)	p value
Prolonged hospital stay (>7 days)	43 (40.2)	17 (23.3)	0.018
Readmission within 6 months	28 (26.2)	11 (15.1)	0.079
Clinical improvement	61 (57.0)	55 (75.3)	0.012
In-hospital mortality	18 (16.8)	6 (8.2)	0.095

Table 4 compares clinical outcomes between anemic and non-anemic chronic heart failure patients. Anemic patients had a significantly higher rate of prolonged hospital stay (>7 days) compared to non-anemic patients (40.2% versus 23.3%, p=0.018). Clinical improvement was observed less frequently in the anemic group than in the non-anemic group (57.0% versus 75.3%, p=0.012). Although readmission within 6 months was more common among anemic patients (26.2% versus 15.1%), this difference did not reach statistical significance (p=0.079). Similarly, in-hospital mortality was higher in the anemic group (16.8% versus 8.2%), but the difference was not statistically significant (p=0.095).

DISCUSSION

The present study evaluated the role of anemia in determining the severity and clinical outcomes of patients with chronic heart failure. Among the 180 patients included in this study, a substantial proportion were older adults, with the highest percentage belonging to the 60-69 years age group (28.3%). Male patients predominated (57.8%) and most participants were from rural areas (62.2%). These demographic findings are comparable with regional cardiovascular epidemiological patterns reported in Bangladesh and neighboring countries, where heart failure is more common among older individuals and rural populations due to delayed diagnosis and limited access to specialized healthcare services. Similar demographic patterns were also observed in cardiovascular epidemiological studies in Bangladesh reported by Ali et al, which highlighted the increasing burden of cardiovascular diseases among aging populations.[14]

In the present study, anemia was detected in 107 out of 180 patients (59.4%), indicating that more than half of the chronic heart failure patients had reduced hemoglobin levels. Among these anemic patients, mild anemia accounted for 41.1%, moderate anemia for 36.4% and severe anemia for 22.5%. These findings are consistent with the observations of Saeed et al, who reported a high prevalence of anemia among heart failure patients in tertiary care hospitals, emphasizing that anemia is a frequent comorbidity in cardiac patients.[15] Similarly, Ahmed et al reported a considerable frequency of anemia among patients with heart failure, further supporting the notion that anemia is commonly associated with cardiac dysfunction.[16] The high prevalence of anemia observed in this study may be attributed to chronic inflammation, nutritional deficiencies, renal dysfunction and hemodilution frequently seen in heart failure patients, as described by Savarese et al.[17]

The present study also demonstrated a significant association between anemia and the severity of heart failure as assessed by the New York Heart Association (NYHA) functional classification. Among anemic patients, the majority were categorized as NYHA class III (43.0%) and class IV (19.6%), whereas non-anemic patients were more frequently in class II (38.4%) and class I (23.3%). The difference between the two groups was statistically significant for class I (p<0.001) and class III (p=0.032). These findings suggest that patients with anemia tend to present with more advanced stages of heart

failure. Comparable results were reported by Parsa et al, who demonstrated a strong relationship between iron deficiency and increasing severity of chronic heart failure.[18] Likewise, Sarate et al highlighted that iron deficiency and anemia contribute significantly to worsening functional capacity in patients with heart failure with reduced ejection fraction.[19]

The clinical outcome analysis in the present study further revealed that anemia was associated with poorer hospital outcomes. Prolonged hospital stay (>7 days) was significantly more common among anemic patients compared to non-anemic patients (40.2% versus 23.3%, p=0.018). In addition, clinical improvement was observed less frequently in the anemic group (57.0%) compared to the non-anemic group (75.3%), which was also statistically significant (p=0.012). These findings are consistent with the results of Sunny et al, who reported that anemia is associated with unfavorable clinical outcomes and longer hospital stays in cardiovascular patients.[20] Similar observations were also noted by Graham et al, who emphasized that iron deficiency and anemia adversely affect functional capacity and clinical recovery in heart failure patients.[21]

Although the rates of readmission within six months (26.2% versus 15.1%) and in-hospital mortality (16.8% versus 8.2%) were higher among anemic patients in this study, these differences did not reach statistical significance. Nevertheless, the trend toward poorer outcomes among anemic patients aligns with the findings of Anker et al, whose research demonstrated that iron deficiency and anemia are associated with increased morbidity and mortality in patients with heart failure.[22] Furthermore, pathophysiological mechanisms such as impaired oxygen delivery, increased cardiac workload and myocardial metabolic dysfunction may explain the negative impact of anemia on heart failure progression, as discussed by Zhang et al.[23]

This study had several limitations that should be considered while interpreting the findings. It was a single-center hospital-based study, which may limit the generalizability of the results to the broader population. The sample size was relatively modest and the study duration was limited to one year. In addition, detailed evaluation of the underlying causes of anemia such as nutritional deficiency, iron status, or inflammatory markers was not performed, which could have provided further insight into its relationship with chronic heart failure.

CONCLUSION

The present study demonstrates that anemia is a common comorbidity among patients with chronic heart failure and is associated with greater disease severity and poorer clinical outcomes. Early detection and appropriate management of anemia may play an important role in improving functional status and overall prognosis in patients with chronic heart failure. Further large-scale multicenter studies are recommended to better understand the impact of anemia on heart failure outcomes and to guide optimal management strategies.

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