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ORIGINAL ARTICLE

Assessing the Connection between Iron Deficiency with Severity of Chronic Heart Failure

Nadrin Parsa[1], Md. Zahirul Islam[2]

Abstract

Background: Based on epidemiologically research conducted in various countries, it has been found that iron deficiency is prevalent among individuals suffering from heart failure.

Objective: The purpose of present study aimed to evaluate the association between Iron deficiency (ID) & severity of chronic Heart Failure(HF) in a tertiary care hospital of Bangladesh.

Methods: This analytical cross sectional study conducted at the department of cardiology ,Sir Salimullah Medical College & Mitford hospital for six (6) months-1st July 2021 to 31st December 2021. A total of 96 patients with chronic HF were included & iron profile was evaluated in all the study patients. Severity will be assessed by LVEF(left ventricular ejection fraction) & NYHA(New York heart Association) class.

Result: A total of 96 patients were studied with 52.1%were male & 47.9% were female. Mean age of the patients was 58.5±12.3 (SD).years & where the majority were aged 61-70 years. About 54.2 % of patients had ID where 47.9% had absolute ID and 6.3% had functional ID according to the laboratory investigations. Presence of ID was significantly associated with NYHA HF class III & class IV & moderate and severe LV dysfunction ($p<0.05$).Severity of heart failure according to ejection fraction was also found significantly associated with presence of ID ($p<0.001$)

Conclusion: Study highlight the burden of iron deficiency in HF patients in Bangladesh. Iron deficiency was present in the majority of the patients with chronic heart failure who were evaluated with iron studies. Iron deficiency was also found significantly associated with severity of CHF which leads us to focus on the importance of diagnosing & treating iron deficiency of these patients.

Key words: Iron deficiency , chronic heart failure

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Introduction:

World wide cardiovascular diseases (CVD)are most frequent causes of death [1]. among them chronic heart failure is a common complication with a prevalence of 1-2% & a major cause of mortality, morbidity & impaired quality of life [2,3]. Anemia & iron deficiency are two comorbidities common in patients with chronic HF & are associated with poor clinical status & worse outcomes.[4] Iron deficiency (ID)is an universal nutritional deficiency worldwide of more than one third of the population ,its association with chronic HF with or without anemia is raising attention.[5,6] Hemoglobin (Hb) concentration of <12.0 g/dl in women & <13.0 g/dl in men was considered as cut-offs for anemia based o n the World Health Organization (WHO) definition. [7]

The impact of iron deficiency is manifold & these include impaired oxygen metabolism , alteration in immune mechanism that may lead to structural & functional change in the myocardium , decreasing oxygen storage in myoglobin & reducing tissue oxidative capacity , all of which leads to impaired left ventricular function.[4] Almost 50% of HF patients have ID with prevalence ranging from 50% in HF with reduced ejection fraction to 64% in HF with preserved ejection fraction as predictor of reduced exercise capacity , quality of life and survival.[8,9] The prevalence estimates for CHF across Asia ranges from 1.26% to 6.7%.[10] As Bangladesh appears to share the same susceptibility to HF with other South Asian population, it estimates about 3.4% in rural and 19.6% in urban

1. Assistant Professor, Department of Community Medicine & Public Health, Medical College for Women & Hospital, Uttara , Dhaka.
2. Associate Consultant Cardiology, Square Hospitals Ltd.Journal of Invasive and Clinical Cardiology

Address of Correspondence: Dr. Nadrin Parsa, Assistant Professor, Department of Community Medicine & Public Health, Medical College for Women & Hospital, Uttara , Dhaka. Mob:01743791982, E-mail: parsaivy2025@yahoo.com

working people with chronic HF . ID is classified into

Absolute iron deficiency when serum ferritin level <30mcg/L, functional iron deficiency is serum ferritin level 30-300 mcg/L and no iron deficiency when S.Ferritin level is normal(>300mcg/L)[11,12,13]

According to the American college of Cardiology assessment of severity of chronic heart failure by ejection fraction was as follows:[14]

severe (EFd"30%), moderate(EF31-39%) , mild(EF40-49%) and normal(EFe"50%).

NYHA classification of HF :[15]

Class I:no symptom of HF

Class II: symptoms of HF with moderate exertion such as ambulating two blocks / two flights of stairs.

Class III: symptoms of heart failure with minimal exertion , such as ambulating one block / one flight of stairs but no symptoms at rest.

Class IV: symptoms of heart failure at rest.

ID and anemia are very prevalent in patients with chronic HF across all ranges of LVEF , with both ID and anemia being present in one third of patients.[16] The present study aims was carried out determine the frequency and burden of iron deficiency in CHF patients in a tertiary care hospital.

Materials & Method:

This analytical cross sectional study conducted in the department of Cardiology,Sir Salimullah medical College & Mitford hospital from July 2021 to December 2021 after obtaining ethical clearance from Ethical Review Committee . A total number of 96 patients clinically diagnosed with chronic heart failure, attending the outdoor & indoor, aged >18 years, both male & female were enrolled by purposive convenient sampling. Excluded from the study were the patients having non cardiac conditions Iron deficiency, pregnant women, patients on iron replacement therapy & patients with recent blood loss.

Informed written consent was taken from the participants after explanation of the nature , objectives & benefit of the study. All respondents underwent through history & clinical evaluation. ECHO was done by Vivid 9 Echo cardiogram machine, GM electronics. Study participants were assessed for their iron status by complete iron profile measured by Vitros 5600 & vitros full automated system, Johnson & Johnson Company.

After collection of all required data, these are checked, verified for consistency & tabulated using the SPSS/PC 23 software. Statistical significance was set as 95% confidence level at 5% acceptable error level. A p value of <0.05 was considered significant.

Result:

A comprehensive analysis was conducted on a total 96 cases, data gathered from department of cardiology, Sir Salimullah Medical College & Mitford Hospital and result is elaborated below:

Majority (36.5%) of the respondents were aged between 61 to 70 years followed by 25% were 51 to 60 years, 15.6% were above 70 years, 14.6% were 41 to 50 years and 8.3% of the patients were aged between 31 to 40 years. Mean age of the patients was 58.5±12.3 (SD) years.

Table-I

Distribution of the respondents by age group (n=96)

Age group	Frequency (n)	Percentage (%)
31-40	8	8.3
41-50	14	14.6
51-60	24	25.0
61-70	35	36.5
>70	15	15.6
Mean±SD	58.5±12.3	
Total	96	100

Among all, 52.1% of the respondents were male and 47.9% were female.

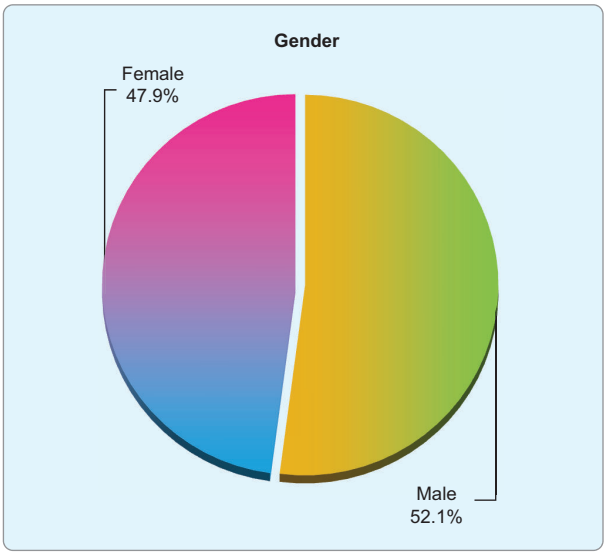

Figure 1: *Gender distribution among the respondents (n=96)*

Majority (62.5%) of the patients had completed graduation or above followed by 9.4% had completed HSC, 2.1% had completed SSC and 13.5% had education level below SSC. Besides, 12.5% of the patients had no formal education.

Table-II

Educational status of the study population (n=96)

Educational status	Frequency (n)	Percentage (%)
No formal education	12	12.5
Below SSC	13	13.5
Completed SSC	2	2.1
Completed HSC	9	9.4
Graduation and above	60	62.5
Total	96	100

Among all, 10.4% had HF with mild EF (Ejection Fraction), 44.8% had HF with moderate EF and 38.5% had HF with severe EF. Besides, 6.3% of the patients had HF with normal EF.

Table-III

Distribution of the patients by severity of HF according to Ejection fraction (n=96)

Severity of HF	Frequency (n)	Percentage (%)
according to EF		
Severe (EF <30%)	37	38.5
Moderate (EF 31-44%)	43	44.8
Mild (EF 45-50%)	10	10.4
Normal (EF>50%)	6	6.3
Mean±SD	35.1±8.2	
Total	96	100

According to NYHA class, 10.4% had Class-I, 37.5% had class -II, 36.5% had class-III and 15.6% had class-IV type of HF.

Table-IV

Distribution of the patients by NYHA HF class (n=96)

NYHA class of HF	Frequency (n)	Percentage (%)
Class-I	10	10.4
Class-II	36	37.5
Class- III	35	36.5
Class- IV	15	15.6
Total	96	100

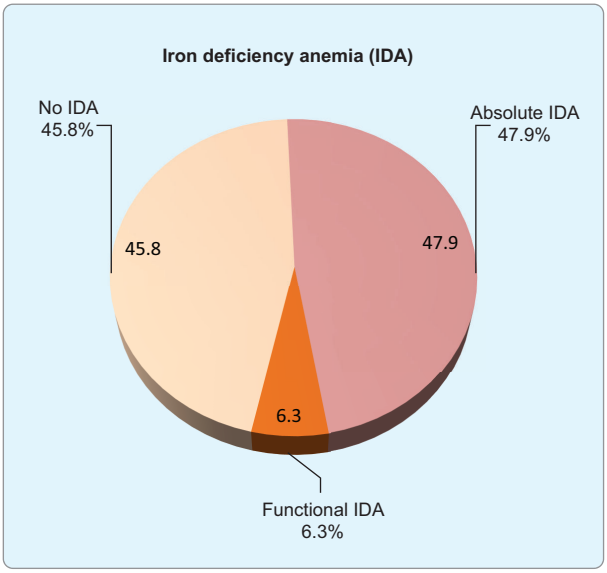

Figure 2: *Presence of Iron Deficiency Anemia (IDA) among the Chronic HF patients (n=96)*

According to Iron profile a total of 54.2% had IDA among the 47.9% had absolute ID (ferritin level Â100 µg/l) and 6.3% had functional ID (ferritin level 100-300 µg/l with TSAT<20%).

ID was significantly common in HF with moderate and severe EF.

Table-V

Association of ID with severity of HF according to Ejection fraction (n=96)

Severity of HF	ID n (%)	No ID n (%)	P value*
Normal EF	0 (0)	6 (13.6)	Â0.01
Mild EF	2 (3.8)	8 (18.2)	
Moderate EF	21 (40.4)	22 (50)	
Severe EF	29 (55.8)	7 (18.2)	

*p value was determined by Chi-square test.

Serum ferritin level was positively correlated with the ejection fraction of the chronic HF patients and that was statistically significant.

Table-VI

Correlation of serum ferritin level with severity of HF according to ejection fraction (n=96)

	Correlation Co-efficient(r)	P value*
Serum ferritin level vs Ejection fraction of the chronic HF patients	0.340	<0.01

*p value was determined by Pearson correlation test.

IDA was significantly common in NYHA HF class-III and class-IV. Those who had Class-II and class-I had significantly lower number of IDA.

Table-VII
Association of IDA with NYHA HF classification (n=96)

NYHA HF class	IDA n (%)	No IDA n (%)	P value*
Class-I	2 (3.8)	8 (18.2)	Â0.01
Class-II	11 (21.2)	25 (56.8)	
Class-III	28 (53.8)	7 (15.9)	
Class-IV	11 (21.2)	4 (9.1)	

*p value was determined by Chi-square test.

Female patients had significantly higher chance of IDA.

Table-VIII
Association of Gender with IDA of the participants (n=96)

	Gender		
	Male n (%)	Female n (%)	P value*
IDA Present	21 (42)	31(67.4)	0.011
No IDA	29 (58)	15 (32.6)	

*p value was determined by Chi-square test.

Discussion :

In this study among the 96 participants 52.1%were male & 47.9% were female with the mean age 58.5±12.3 years. It was observed that ID was significantly higher in females (67.4%) compared to males. Jankowska et al. also revealed that ID was more prevalent in women.[17] No significant difference was found between both groups regarding age & educational status. ID was very prevalent in the patients with chronic heart failure and most of it was due to absolute ID . [18]The current study revealed that 54.2% of the patients had ID, among them 47.9% had absolute ID & 6.3% had functional ID . A previous study by Kumer et al found absolute ID was present in 48.7% respondents and functional ID was present in 27.3% patients.[6] OEur study found that serum ferritin level was positively correlated with the ejection fraction. ID was significantly higher among the patients of chronic HF with moderate to severe EF. According to NYHA class , 10.4% had class –I , 37.5% had class _II , 36.5% had class –III and 15.6% had a class –IV type of HF. The recent study shows that among the total respondents most of the patients with ID (53.8%) is in NYHA class –III. ID significantly increases with increased NYHA class (p value was <0.01). Ebner et al . also observed that the prevalence of ID increases with the severity of HF.[20] The prevalence of ID reaches 50% among ambulatory patients with HF and ID is an independent predictor of reduced exercise ,quality of life and mortality.[15]

Conclusion: in this study, iron deficiency is prevalent in nearly half of the patients of chronic heart failure. Moreover a significant association was observed between presence of ID and severity of HF according to NYHA class and ejection fraction. Therefore, screening for ID in patients with heart failure is highly recommended, considering its relevance for the prognosis of these patients. Longitudinal, mechanistic and intervention studies are needed to investigate the contribution of the different factors implicated in the pathophysiology of ID in heart failure.

Limitation : There are some potential limitations to our study . The study was conducted in single study center due to it limitation of resources which can create biasness in selection of patients. As a result, sample size was also small during the study period in a single center. The study was done in a analytical cross sectional design therefore, many other important outcomes could be missing. A further large multicenter cohort was therefore recommended to support the findings of this study.

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