A Study of Left Ventricular Dysfunction in Patients with Severe Iron Deficiency in a Tertiary Care Hospital, Nandyal

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Date of submission: 13/10/2020

Date of Peer review:12/12/2020

Date of Acceptance:28/1/2021

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DOI:10.47799/pimr.0902.11

ABSTRACT

Background: Anaemia is one of the major public health problems worldwide. Commonest nutritional deficiency affecting more than 1.2 billion individuals worldwide 1. Iron deficiency anaemia is associated with a reduction in physical well being and decreased exercise capacity. The prevalence of anaemia is 30% in stable heart failure and 50% in hospitalized heart failure patients, compared with less than 10% in the general population 2.In iron deficiency anaemia, to maintain adequate oxygen delivery, cardiac output can increase by the compensatory increase in blood volume, preload, heart rate, and stroke volume, and decrease in afterload.If severe iron deficiency anaemia left untreated, it could cause secondary organ damage. Chronic severe iron deficiency anaemia causes cardiac remodelling, cardiomegaly, arrhythmia, left ventricular hypertrophy, and heart failure.

Aim: To study the left ventricular dysfunction in patients with severe iron deficiency admitted in a tertiary care hospital.

Materials and Methods: A Hospital-based Prospective study was conducted in the Department of Medicine, Santhiram medical college & general hospital for a 2 year period. Universal Sampling Technique was used for the selection of study subjects. All the patients coming to the medicine department during the study period with age > 18years with informed written consent taken from the patient,Hemoglobin< 6gm/dl (according to WHO criteria) and Red cell indices suggestive of iron deficiency anaemia The final sample size was 100 subjects.

Results: Out of 100 patients, 62% were females, and 38% were males in the study group. The mean age in the study population was 40.68±12.5 years, with the minimum age being 18 years and maximum age is 70 years. The prevalence of LV dysfunction in the study group was 61%.51% of the total population had systolic dysfunction and 10% had diastolic dysfunction.39% of the total population had normal LV function. In patients with systolic dysfunction, 72.5% were females, and 27.5% were males. In diastolic dysfunction, 50% were males, and 50% were females.

Conclusion: As iron deficiency anaemia is more prevalent globally, its consequences on the cardiovascular system were studied. Iron deficiency anaemia is a major public health problem in developing countries, and it causes major cardiovascular morbidity and mortality. Severe iron deficiency anaemia causes structural changes in the left ventricle leading to eccentric or concentric hypertrophy, which predisposes the patients to develop left ventricular dysfunction. Hence, early diagnosis and management of iron deficiency anaemia can reverse remodelling and prevent left ventricular dysfunction. Thus, reducing major cardiovascular morbidity and mortality.

INTRODUCTION

Anaemia is one of the major public health problems worldwide. Commonest nutritional deficiency affecting more than 1.2 billion individuals worldwide [1]. Iron deficiency anaemia is associated with a reduction in physical well being and decreased exercise capacity. The prevalence of anaemia is 30% is stable heart failure and 50% in hospitalized heart failure patients, compared with less than 10% in the general population [2].In iron deficiency anaemia, to maintain adequate oxygen delivery, cardiac output can increase by the compensatory increase in blood volume, preload, heart rate, and stroke volume, and decrease in afterload.If severe iron deficiency anaemia left untreated, it could cause secondary organ damage. Chronic severe iron deficiency anaemia causes cardiac remodelling, cardiomegaly, arrhythmia, left ventricular hypertrophy, and heart failure [3]

AIM AND OBJECTIVES: To study the left ventricular dysfunction in patients with severe iron deficiency admitted in a tertiary care hospital.

MATERIALS AND METHODS: A hospital-based prospective study was conducted in the Department of General Medicine, Santhiram Medical College, and General Hospital for a 2 year period after taking approval from the Hospital Ethics and Research Committee.

Sampling Technique and Sample Size: Universal Sampling Technique was used for the selection of study subjects. All the patients coming to the medicine department during the study period and fulfilling the inclusion criteria were taken for study after taking prior informed consent. The patients included in the study were from both ICU and wards. The final sample size came to be 100 subjects.

Inclusion Criteria

1) Age> 18years with informed written consent taken from the patient.

2) Hemoglobin< 6gm/dl (according to WHO criteria).

3) Red cell indices suggestive of iron deficiency anemia

Exclusion criteria

1) Patients with haemoglobin> 6gm/dl

2) Age< 18years.

3) Patients without informed consent.

4) Patients with co-morbidities like chronic kidney disease, chronic liver disease, anaemia in pregnancy, dimorphic anaemia, and cardiac diseases (e.g., Ischemic heart disease, Rheumatic heart disease).

Data Analysis

All patient profiles were recorded in proforma, and findings were tabulated, SPSS24 was used for the analysis of the data.

RESULTS:

Out of 100 patients, 62% were males, and 38% were males in the study group. Hence, severe iron deficiency anaemia was predominantly seen in females.

Table - 1: Female: Male ratio of Iron deficiency anaemia

		Frequency	Percent
Sex	FEMALE	62	62.0
	MALE	38	38.0
	Total	100	100.0

The prevalence of LV dysfunction in the study group was 61%.51% of the total population had systolic dysfunction and 10% had diastolic dysfunction.39% of the total population had normal LV function.

Table-2: Prevalence of LV dysfunction:

LV DYSFUNCTION				
	SYSTOLIC DYSFUNCTION	DIASTOLIC DYSFUNCTION	NORMAL LV FUNCTION	TOTAL
	51	10	39	100
Total	61		39	100

In patients with systolic dysfunction, 72.5% were females, and 27.5% were males.In diastolic dysfunction, 50% were males, and 50% were females.

Table-3: Relationship between systolic dysfunction & sex:

RELATIONSHIP BETWEEN SYSTOLIC DYSFUNCTION & SEX						
			Sex		Total	P-Value
			Female	Male		
SYSTOLIC DYSFUNCTION	Yes	Count	37	14	51	0.027
		%	72.5%	27.5%	100.0%	

	No	Count	25	24	49	
		%	51.0%	49.0%	100.0%	
Total		Count	62	38	100	
		%	62.0%	38.0%	100.0%	

Table-4: Relationship between Diastolic dysfunction & sex

RELATIONSHIP BETWEEN DIASTOLIC DYSFUNCTION & SEX						
			Sex		Total	P-Value
			Female	Male		
SYSTOLIC DYSFUNCTION	Yes	Count	5	5	10	0.41
		%	50.0%	50.0%	100.0%	
	No	Count	57	33	90	
		%	63.3%	36.7%	100.0%	
Total		Count	62	38	100	
		%	62.0%	38.0%	100.0%	

Discussion:

Iron deficiency is the most common nutritional deficiency in developed and developing countries. It is the most common anaemia in India. The prevalence is higher in infants, pregnant females, and poor people.Anemia and iron deficiency are important co-morbidities that exist in patients with heart failure and are associated with poor clinical status and worse outcomes. Iron deficiency in patients with heart failure can be absolute, when total body iron is reduced or functional when total body iron is normal but inadequate to meet the needs of target tissues because of sequestration in the storage pool. Iron deficiency is independently related to exercise intolerance expressed as decreased peak oxygen uptake and augmented ventilatory response to exercise in patients with chronic heart failure. Thus, iron has the role of the cofactor in the skeletal and cardiac muscle function. In patients with chronic heart failure, iron deficiency, even in the absence of anaemia, can aggravate the underlying disease and have a negative on clinical outcomes and quality of life. The 2016 European Society of Cardiology guidelines for the diagnosis and treatment of acute and chronic heart failure recognize iron deficiency as co morbidity in chronic heart failure and recommend iron status screening in all newly diagnosed patients with chronic heart failure.

Abdulla Ahmed et al. (2018)[4] study, which was conducted among 500 patients, showed that the prevalence of iron deficiency anaemia was 54% females and 46% males, indicating that iron deficiency was more prevalent in females.

Systolic dysfunction is characterized by a reduced ejection fraction of <45%, and diastolic dysfunction is characterized by a preserved ejection fraction of >45%.The mean LV ejection fraction in the study group was 46.350±11.40, with the minimum being 25% and maximum being 64%.In the study group, in patients with Hb <4gms/dl (30 cases), 56.7% had systolic dysfunction, and in patients with >4gms/dl(70 cases), 48.6% had systolic dysfunction. Thus, indicating that the prevalence of systolic dysfunction increases as the severity of anaemia increase. In the present study, in patients with Hb <4gms/dl (30 cases), 10% had diastolic dysfunction, and in patients with Hb >4gms/dl (70 cases), 10% had diastolic dysfunction. Hence, the prevalence of diastolic dysfunction is not associated with the severity of anaemia.

In Yeo TJ et al. (2014)[5] study, iron status was assessed in 751 heart failure patients with a mean LV ejection fraction of 34.4±15.9%. Iron deficiency was highly prevalent and independently related to the functional capacity and outcomes in their cohort. Those findings suggest a pathophysiological role of iron deficiency in heart failure and support its importance in therapeutic targets in Southeast Asian patients with heart failure.

In Rangel et al. (2014)[6] , this study prospectively evaluated 127 patients with stable chronic heart failure and left ventricular ejection fraction =45% with mean LV ejection fraction of 28±9.1%. Among 127 patients, 46 (36%) patients had an iron deficiency. This study also concluded that iron deficiency carried a higher risk of an unfavourable outcome, irrespective of the presence of anaemia.

In Sunil Verma et al. study (2016)[7], there were 67.5% (27/40). Of the 27 iron-deficient patients, 22 had absolute iron deficiency, and 5 patients had a functional iron deficiency. Patients with iron deficiency anaemia had more advanced NYHA class (III and IV) with iron deficiency anaemia (37.4% vs. 30.77%, P = 0.697). He also mentioned that besides being the component of haemoglobin, iron is also an integral part of myoglobin and the cellular respiratory chain complex. Heart failure with low output states requires a compensatory increase in the activity of myoglobin, haemoglobin, and respiratory chain complex for the more efficient cellular utilization of oxygen. Hence, iron deficiency, even in the absence of anaemia, can compromise the function of the respiratory chain and can exacerbate the symptoms of heart failure.

Iron deficiency anaemia causes structural remodelling of the left ventricle that is concentric and eccentric hypertrophy leading to left ventricular dysfunction. Hence, early detection of increased LV mass is important to initiate early treatment, which limits further progression and left ventricular dysfunction.

Conclusion:

These are the following findings from this study;

1) As iron deficiency anaemia is more prevalent globally, its consequences on the cardiovascular system were studied

.2) Iron deficiency anaemia is a major public health problem in developing countries, and it causes major cardiovascular morbidity and mortality.

3) Severe iron deficiency anaemia causes structural changes in the left ventricle leading to eccentric or concentric hypertrophy, which predisposes the patients to develop left ventricular dysfunction.

4) Hence, early diagnosis and management of iron deficiency anaemia can reverse remodelling and prevent left ventricular dysfunction. Thus, reducing major cardiovascular morbidity and mortality.

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How to cite this article : Nagarjuna Reddy P. A Study Of Left Ventricular Dysfunction In Patients With Severe Iron Deficiency In A Tertiary Care Hospital,Nandyal.Perspectives in Medical Research 2020; 9 (2):49-52

DOI:10.47799/pimr.0902.11

Sources of Support: Nil, Conflict of interest: None declared