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DIAGNOSTIC EVALUATION OF FERRITIN DEFICIENCY IN CARDIOVASCULAR DISEASE PATIENTS

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Abstract
The occurrence of Iron Deficiency (ID) in heart failure significantly impacts morbidity and mortality. This study assesses ferritin deficiency among HF patients, comparing iron metabolism parameters between individuals with and without ID. A cohort of 140 participants, comprised of both males and females, were evaluated. Blood samples were collected to measure hemoglobin (Hb), A total profile consists of ferritin, serum iron, total iron-binding capacity (TIBC), and transferrin saturation (TSAT). It was found that there were statistically significant differences in ferritin (p=0.01), serum iron (p=0.05), and TSAT (p=0.04) levels between ID and non-ID groups, with ID patients demonstrating markedly lower levels in these parameters. Ferritin levels averaged 80.6 ng/ml in the ID group versus 274.6 ng/ml in the non-ID group, underscoring ferritin's role as a critical marker of iron storage. Similarly, reduced serum iron and TSAT levels in ID patients reflect diminished iron transport and availability. Although Hb and mean corpuscular volume (MCV) values showed Lower trend but not significant levels in ID patients (p=0.12 and p=0.17 respectively), these parameters alone were inadequate for diagnosing ID. The findings emphasize the diagnostic utility of ferritin, serum iron, and TSAT levels in assessing iron deficiency among HF patients.

Keywords: Iron deficiency, Heart failure, Ferritin, Hemoglobin, Iron metabolism, Transferrin saturation, Anemia, Morbidity, Mortality

Introduction

HB <13g/dl in males and <12g/dl in females is considered Anemia. The association is found more often in patients with heart failure than those with other diseases, and it has been shown to increase mortality in both acute and chronic heart failure patients. In countries like India, nutritional deficiency and worm infestations, along with other mechanisms, are also considered contributing factors.[1]Among heart failure patients, anaemia caused by ID is among the leading causes. But other factors must also be considered. As part of a variety of functions in our bodies, iron plays a pivotal role in human health.[2]

In addition, infants, young children, adolescents, elderly people, and women are at a high risk of contracting a disease. This is especially true during menstruation and pregnancy for women. There has been a considerable amount of research in patients with chronic diseases that are characterized

by inflammatory activation in recent decades.[3] These efforts have ultimately led to the realization of high incidence of ID has also been linked to heart failure, chronic kidney disease, cancer, and inflammation of the bowel.[4]

Research into ID has been conducted in the past few years in conditions like chronic kidney disease, heart failure, chronic inflammation, There have been several mechanisms identified and corrective measures developed for cancer. The purpose of our study was to assess whether heart failure patients had ferritin deficiency.[5]

Materials & Methods

There were 140 participants in this study, both males and females. During the course of this study, all patients provided consent. Data such as name, age, gender, and other details were recorded. Depending on ferritin concentration and the amount of ferritin in the blood, ID may be defined as either absolute (ferritin < 100) or functional (transferrin saturation index < 20% and ferritin 100-299).[6] Measurements of hemodynamic indices were performed on EDTA tubes containing venous blood. In the study, ferritin was measured (ng/ml), serum iron was measured (micrograms per dl), total iron binding capacity was measured (micrograms per dl), and transferrin saturation was measured. In general, serum ferritin levels should range from 30 to 300ng/ml. These results were analyzed based on the data. P values of less than 0.05 were used to determine statistical significance.[7]

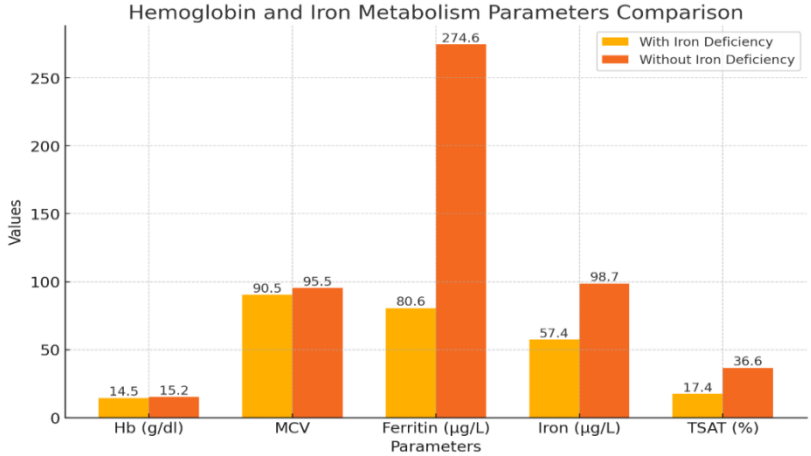
Results

Table 1: Patients' distributions

Gender	Patients with iron deficiency	Patients without iron deficiency
Male	65	30
Female	35	10

Table 2: A study of hemoglobin and iron metabolism parameters

Parameters	Patients with iron deficiency	Patients without iron deficiency	P value
Hb (g/dl)	14.5	15.2	0.12
MCV	90.5	95.5	0.17
Ferritin (µg/L)	80.6	274.6	0.01
Iron (µg/dl)	57.4	98.7	0.05
TSAT (%)	17.4	36.6	0.04



Graph 1 : Hemoglobin and iron metabolism parameters

Discussion

A number of studies have found ID to be common among patients with chronic or acute heart failure; however, the definitions used in these studies vary. Nutritional deficiencies (mainly iron) are responsible for approximately a third of elderly anemia, followed by chronic inflammation and chronic kidney disease, and unexplained anemia. Primary hematologic diseases account for a smaller proportion. Guidelines can be used to diagnose and treat elderly anemia. It is essential to locate the cause of absolute ID, particularly gastrointestinal blood loss caused by benign or malignant conditions. There are several factors associated with anemia in patients with HF. In the section on ID in HF, it is discussed separately. Deficits of vitamin B12 and folate, however, are rare. Low blood oxygen levels stimulate red blood cell (RBC) production by stimulating erythropoietin production. A typical abnormality of this hormone occurs in HF because it is produced abnormally in the specialized cells that produce erythropoietin in the kidney cortex and the outer medulla. In most cases of HF, renal dysfunction is present. [8] It is possible, however, that structural renal disease could reduce erythropoietin production in rare cases.

The comparison of hemoglobin and iron metabolism parameters between patients with and without iron deficiency reveals several notable findings. Hemoglobin (Hb) and mean corpuscular volume (MCV) are slightly lower in iron-deficient patients, though these differences are not statistically significant (Hb $P = 0.12$, MCV $P = 0.17$). This suggests that while these values may trend lower in iron-deficient individuals, the variation within this sample does not make these metrics clinically relevant markers on their own. In contrast, ferritin levels demonstrate a significant difference between the two groups, with iron-deficient patients exhibiting much lower average ferritin concentrations (80.6ng/ml) compared to those without deficiency (274.6 ng/ml) and a P value of 0.01. [9]As ferritin is a marker of iron storage, this reduction aligns with its expected role in reflecting diminished iron reserves in iron-deficient patients. Similarly, serum iron levels and transferrin saturation (TSAT) both show significant decreases in the iron-deficient group, with P values of 0.05 and 0.04, respectively. The lower serum iron and TSAT percentages (57.4 µg/dl and 17.4%, respectively) in iron-deficient patients indicate reduced iron transport and availability, as TSAT reflects the proportion of transferrin-bound iron, a crucial component of effective iron distribution in the body. The most striking differences between the groups lie in ferritin, serum iron, and TSAT levels, which are significantly reduced in iron-deficient patients.[10,11] While hemoglobin and MCV might not clearly indicate iron deficiency in every case, markers of iron storage and transport (such as ferritin and TSAT) offer more reliable insights for diagnosing iron deficiency, emphasizing the value of these parameters in clinical assessments.[12]

Conclusion

Iron deficiency anemia is an independent predictor of mortality in Heart failure patients. Prompt evaluation and treatment of this group of patients is vital in reducing the morbidity and mortality.

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