

A Study to Correlate Iron Deficiency Anemia with Heart Failure using Hematological Parameters and ECG

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Abstract:-

Introduction: India has the highest prevalence of iron deficiency anemia which is a significant contributor in the prognosis as well as progression of cardiac disease .Heart disease itself is the leading cause of death in India. Using simple hematological parameters and ECG we have established co-existence between iron deficiency and cardiac disorders.

Materials and methods: Study duration was one year in few selected areas of Bilaspur and Ambikapur. Total of 36 subjects with anemia were found who underwent tests like Hb, MCV,MCH, MCHC, Hematocrit and ECG to detect cardiac disease as well and statistical analysis done.

Results: The mean age of the patient was 52 ± 2.5 years. The mean \pm SD Hb was 6.5 ± 0.2 gm/dl. The mean \pm SD for MCV,MCH,MCHC was 70.2 ± 2.1 fl, MCH was 22.2 ± 2.4 pg, and that for MCHC was 25.5 ± 1.2 g/dl respectively. The Hematocrit % ranged between 18.7 to 24.5 with the mean \pm SD value of 20.1 ± 2.1 . ECG findings varied from ST segment depression, T wave inversion, prolonged QT interval, abnormal QRS complex.

Conclusion: Every anemic patients must undergo few tests for an early diagnosis of underlying heart disease so that without further delay , prompt management can prevent the associated morbidity and mortality.

Keywords:- Iron Deficiency Anemia, Heart Disease.

I. INTRODUCTION

Iron deficiency anemia is one of the most prevalent forms of malnutrition. Globally, 50% of anemia is attributable to iron deficiency and accounts for approximately 841,000 deaths worldwide. Africa and Asia bear 71% of the global mortality burden. As per WHO, the recommended cut off for anemia is (Hb<13g/dl in males,<12g/dl in females).According to the Global Burden of Disease study 2016,iron deficiency is 1 of the 5 leading causes of years lived with disability¹ and heart disease as one of the disastrous comorbidity.India stands on the top with the highest prevalence around 39.6 % ,among the sixteen countries affected with anemia.Although the progression to heart disease is determined by multiple factors,there is significant attribution of anemia in the pathophysiology, treatment as well as prognosis of heart

failure. The prevalence of anemia was reported around 37.2% in a meta analysis of total 153,180 patients with heart failure across 34 published studies over a seven year period(2001-2007).² Fifty eight percent of women in Chattisgarh have anemia.while twenty seven percent of men are anemic according to a press release issued by Tata chemicals limited.

Aims and objectives

To establish correlation between iron deficiency anemia and heart disease using hematological tests like Hemoglobin(Hb), mean corpuscle volume(MCV), mean corpuscular hemoglobin (MCH), mean corpuscular hemoglobin concentration (MCHC) , Hematocrit and ECG findings.

II. MATERIALS AND METHODS

This study was carried out in patients from few selected areas of Bilaspur(Lormi, Takhatpur, Sarkanda, Lingiadeah,) and Ambikapur (Patparia, Bhagwanpur, Namnakala) over a period of one year from January 2020 to December 2020. Patients were randomly selected in these areas having clinical features of anemia and through contact and vitals measured.They were investigated at CIMS bilaspur and Holy Cross Hospital Ambikapur using tests like Hemoglobin, MCV,MCH,MCHC,Hematocrit using 5 part Hematology analyser ,BC 5000 of Minray Company and ECG changes were studied in them.Total of 80 were patients included in the study initially i.e those who had anemia but coexistent cardiac disease was present only in 36 of them . Hence 36 patients were our study subjects. Details were entered in a pre designed format , inclusion and exclusion criteria were applied and statistical analysis done using SPSS software version 19. Medical management if required was done at the respective hospitals.

Inclusion criteria:

- 1.Age between 15 to 65 years.
- 2.Hb <7gm%
- 3.Physical symptoms of severe anemia like pallor, tachycardia, panting and sighing.
4. ECG changes-ST depression, T wave inversion, prolonged QT interval,QRS complex changes.

Exclusion criteria:

- 1.Age<15 years and > 65 years.
- 2.Pregnancy
- 3.Leukemia
- 4.Sickle cell anemia
- 5.Renal disease,thyroid disorders,skeletal disease,respiratory disorders.
- 6.Recent history of blood loss.
- 7.Diagnosed case of heart disease.

III. RESULT

The mean age of the patient was 52± 2.5 years. There were total of 20 female and 16 male. 20 (55.5%) of them belonged to lower socioeconomic status as per modified BG Prasad scale with per capita income <1050. Total of 30 (83.3%) patients belonged to rural background while only 6(16.6%) belonged to urban area. 33.3% were literate and 66.7% were illiterate.(Table 1).

Table 1: Sociodemographic features of study population

Age group(years)	N	%
15-25	1	2.7
26-35	2	5.5
36-45	8	27.7
45-55	18	44.4
56-65	7	19.4
Sex		
Female	20	55.5
Male	16	44.5
Socioeconomic status		
Upper	0	0
Upper Middle	2	5.5
Middle	4	11.1
Lower Middle	10	27.7
Lower	20	55.5
Locality		
Rural	30	83.3
Urban	6	16.6
Literacy		
Literate	12	33.3
Illiterate	24	66.7

The Hb estimation revealed that out of 36 studied patients, 16 had hemoglobin between 6-7gm/dl, while 10 had Hb between 5-5.9gm/dl and the remaining 10 had Hb below 5 gm/dl. The mean ± SD Hb was 6.5 ± 0.2 gm/dl. It was surprising to note that despite these Hb parameters subjects didn't find it necessary to report to hospital. MCV, MCH, MCHC were also studied which showed all the parameters were decreased in the subjects. The mean ± SD for MCV, MCH, MCHC was 70.2 ± 2.1 fl, MCH was 22.2 ± 2.4 pg, and that for MCHC was 25.5 ± 1.2 g/dl respectively.

The Hematocrit % ranged between 18.7 to 24.5 with the mean ± SD value of 20.1 ± 2.1.(Table 2)

Table 2: Hematological parameters of the study subjects

Parameter	Mean ± SD	Range
Hemoglobin	6.5 ± 0.2	12-15g/dl
MCV	70.2 ± 2.1	80-100fl
MCH	22.2 ± 2.4	27-32 pg
MCHC	25.5 ± 1.2	32-36 g/dl
Hematocrit	20.1 ± 2.1	36-45%

After estimation of anemia using Hb, MCV, MCH, MCHC, Hematocrit, those who met our inclusion criteria were subjected for an ECG. ECG findings varied from ST segment depression, T wave inversion, prolonged QT interval, abnormal QRS complex.(Table 3).

Table 3: ECG changes of the study participants

ECG findings	N(%)
ST segment depression	12(33.3%)
T wave inversion	8(22.2%)
Prolonged Qt interval	6(16.6%)
Abnormal QRS complex	10(27.7%)

IV. DISCUSSION

Anaemia is defined as a reduction in the concentration of circulating haemoglobin or oxygen-carrying capacity of blood below the level that is expected for healthy persons of same age and sex in the same environment. There is strong correlation between anemic patients and heart failure. Apart from hospitalized patients it exists equally in the general population.³ There exists strong relationship between anemia and demographics and outcomes which includes old age, female, diabetes, lower quality life, chronic kidney disease etc.⁴⁻⁶ which is similar to our study. Our findings are also consistent with **Malhotra P et al**⁷ which shows that rural background, female sex and low socioeconomic conditions are associated with increased prevalence of anemia. **Balarajan Y et al**⁸ highlights the importance of income and its association with anemia in their study, "**Anemia in middle and low income countries**" which has similar results as our study.

Hemoglobin is a iron rich protein contained in the RBC that carries oxygen. The hematocrit reflects the amount of space in the blood that is occupied by RBC's and is affected by the number and size of RBC'. The mean corpuscle volume(MCV) is a measurement of the average size of the RBC's. The mean corpuscular hemoglobin (MCH) reflects the average amount of hemoglobin in a person's RBC while the mean corpuscular hemoglobin concentration (MCHC) is a measurement of the average amount of hemoglobin in the RBC's compared to the size of the RBC's. All these parameters can be measured using complete blood count(CBC). The end results of our investigation shows microcytic hypochromic anemia, which implies iron deficiency.

Whether anemia causes heart failure or just affects the prognosis is a matter of debate among study experts. Multiple mechanisms appear to contribute to poor outcomes in these patients. Reduced oxygen delivery to metabolizing tissues in anemic subjects triggers a host of hemodynamic, neurohormonal, and renal alterations, leading to increased myocardial workload, which could cause adverse Left ventricular remodeling and Left ventricular hypertrophy. There are many researches done worldwide relating anemia with heart failure, its etiology, pathogenesis, and treatment outcomes. Few of the studies done in India with similar findings as ours are **Inder S. Anand and Pankaj Gupta**⁹, **Dorairaj Prabhakaran et al**¹⁰, **Himanshu Arora et al**¹¹. All these studies have established that among all the types of anemia, iron deficiency anemia which is most prevalent in our Indian scenario and is the main culprit leading to the disastrous outcome as it also causes myocardial iron depletion too and thus the consequences.

V. CONCLUSION

European college of cardiology has recommended that iron deficiency been ruled out in every patient presenting as heart failure. There are many treatment modalities present including dietary intervention, intravenous iron therapy, erythropoietin stimulating agents that can prevent as well as slower down the progression of cardiac disease. Using few hematological studies we have not only detected iron deficiency but heart disease as well when all of them were actually not aware of it.

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