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Original Research Article

A Study of Clinical Spectrum of Iron Deficiency Among Patients in Tertiary Care Centre

Percy Priyanka Talari[1], D. Srinivasa Rao[2], B Nirmala Kumar [3], Kristudasu Palaparthi[4]

[1]Assistant Professor, Department of General Medicine, Guntur Medical College, Guntur

[2]Professor & HOD, Department of General Medicine, Guntur Medical College, Guntur

[3]Associate Professor, Department of General Medicine, Guntur Medical College, Guntur

[4]Assistant Professor, Department of General Medicine, Guntur Medical College , Guntur

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Corresponding author: Percy Priyanka Talari

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Abstract

Background: Anemia refers to a condition where there is a decrease in the number of red blood cells or decrease in the amount of haemoglobin in the blood. Anemia is a common consequence of iron deficiency, iron deficiency itself can manifest before anemia develops.

Aim and Objectives: we have undertaken this study to know clinical spectrum in patients with Iron deficiency without anaemia and its complication.

Material and Method: This was a cross-sectional study carried out in department of General medicine at Guntur Medical College, Guntur. included the clinical profile of 200 cases in both outpatient and inpatient to General medicine department during the study period, after getting ethical approval and satisfying inclusion and exclusion criteria.

Results: Among all the patients we have observed there were 61 patients without Anemia and 139 patients were with Anemia with iron deficiency. Mean difference in age between NAID and AID was not statistically significant, but mean difference of others parameters like haemoglobin, serum ferritin, were statistically highly significant and mean difference of total bilirubin was statistically significant between NAID and AID. Comorbid conditions and other sign and symptoms were statistically significant with ferritin level.

Conclusion: Two thirds of iron deficiency patients were in iron deficiency anemia group and one third of patients presented with non-anaemic iron deficiency group who presented with symptoms.

Keywords: Iron deficiency, Anemia, Non-anemia etc.

Introduction

Anemia refers to a condition where there is a decrease in the number of red blood cells or decrease in the amount of haemoglobin in the blood, resulting in reduced oxygen carrying capacity. Iron is an essential nutrient required for the production of haemoglobin, the protein that carries oxygen in the blood.

While anemia is a common consequence of iron deficiency, iron deficiency itself can manifest before anemia develops. In the early stages of iron deficiency, the body

may deplete its iron stores without a significant drop in haemoglobin level. This condition is known as iron deficiency without anemia

Iron deficiency and iron-deficiency anaemia are global health problems and common medical conditions seen in everyday clinical practice. Iron is essential for biological functions, including breathing, energy production, synthesis, and cell proliferation. Since excess iron levels can be toxic, however, its absorption is restricted to 1 to 2 mg daily, and most of the iron needed daily (around 25 mg daily) is provided by macrophage recycling to phagocytosis senescent erythrocytes. These processes are regulated by the hepcidin hormone, which retains iron in the total body within normal ranges, preventing both iron deficiency and excess.[1]

Iron-restricted erythropoiesis indicates that iron delivery to erythroid precursors is impaired, regardless of how full the stores are. Stores may be regular or even increased because of iron sequestration in cases of anemia of chronic inflammation, which observed in patients with autoimmune disorders, cancer, infections, and chronic kidney diseases.[2]

Webb and Oski observed that anemic students had lower scores on a standardized scholastic achievement test than non-anemic students. Thus, a better understanding of the possible cognitive effects of iron deficiency in the absence of anemia is particularly essential because of the high rate of this condition in adolescent girls.[3] So, Iron deficiency with or without concurrent anemia affects 30% of the global population, making it the most widespread nutrient deficiency. Thus, we have undertaken this study to know clinical spectrum in patients with Iron deficiency without anaemia and its complication.

Material and Method

This was a cross-sectional study carried out in department of General medicine at Guntur Medical College, Guntur. included the clinical profile of 200 cases in both outpatient and inpatient to General medicine department during the study period, after getting ethical approval and satisfying inclusion and exclusion criteria given bellow.

Inclusion Criteria

- Adolescent group 12-19 yrs age.
- Patients between 20-59 years.
- Hospital based population.

Exclusion Criteria

- Haemoglobinopathies.
- Haemolytic anaemias.
- Patients with chronic kidney disease and other chronic inflammatory diseases.
- Traumatic blood loss.

Method

Standard proforma was used and data of all the 200 cases was entered obtaining consent. Patient assessment was done by detailed history, questionnaire, physical examination and objective tests and lab investigations. Blood was drawn to measure Serum parameters such as complete blood picture, creatinine, Blood Urea, serum ferritin.

Statistical Analysis

Collected data were entered in the Microsoft Excel 2016 for further statistical analysis. Quantitative data were expressed in terms of mean and standard deviation where categorical variables were expressed in terms of frequency and proportion. Mean difference was assessed by using t-test and association were assessed with the help of chi-square test. P-value<0.05 was considered as statistically significant. Statistical analysis were done by using statistical software SPSS version 25

Observation and Results

In the present study we have included 200 patients after following inclusion and exclusion criteria during the study period, among all the patients we have observed

there were 61 patients without Anemia and 139 patients were with Anemia with iron deficiency shown in the following figure

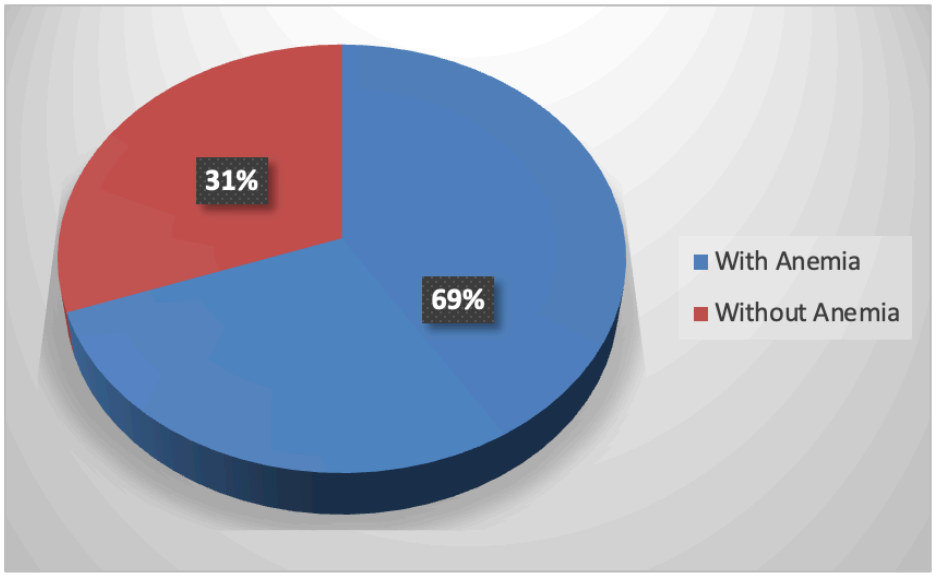

Figure 1: Distribution of iron deficiency with and without Anemia

Table 1: Distribution of Baseline parameters

Parameters	Frequency	Percentage
Age		
12-19 Years	17	8.5
20-39 Years	95	47.5
40-59 Years	82	41
>59 Years	6	3
Ferritin Level		
20-50	87	43
<20	113	56.5
Comorbid Conditions		
DM	32	16
Hypertension	32	16
Thyroid	57	28.5

Table 2: Descriptive in Non-Anaemic and Anemic iron deficiency group

Parameters	Mean ± SD		t-test	P-value
	NAID	AID		
Age	34.36±11.94	37.3±12.53	1.54	0.1229
Haemoglobin	11.82±0.79	8.14±1.97	14.08	<0.001**
Serum Ferritin	28.15±12.68	16.45±14.76	5.37	<0.001**
MCV	81.28±6.6	68.08±11.03	8.68	<0.001**
MCH	26.83±2	22.21±5.76	6.097	<0.001**
MCHC	32.68±5.33	29.22±3.5	5.44	<0.001**
PCV	33.64±3.52	25.25±5.58	10.8	<0.001**
Total Bilirubin	0.831±0.23	0.76±0.23	2.01	0.045*

**P-value<0.001, *P-value<0.05, highly significant and significant at 5% level of significance

Table 3: Association between age group and ferritin levels

Age	Ferritin Level			P-value
	20-50	<20	Total	
12-19 Years	9	8	17	0.19
20-39 Years	38	57	95	
40-59 Years	35	47	82	
>59 Years	5	1	6	
Total	87	113	200	

Descriptive statistics showed in above table 2, mean difference in age between NAID and AID was not statistically significant, but mean difference of others parameters like haemoglobin, serum ferritin, MCV, MCH, MCHC, PCV were statistically highly significant and mean difference of total bilirubin was statistically significant between NAID and AID

Table 3: Distribution of ferritin level among sign and condition in non-anaemic iron deficiency group

Signs, Symptoms and Comorbidity (Present)		Ferritin Level		Total	P-value
		20-50	<20		
DM	NAID	5	0	5	0.31
	AID	11	16	27	<0.001**
Hypertension	NAID	7	3	10	0.93
	AID	9	13	22	<0.001**
Thyroid	NAID	9	8	17	0.12
	AID	11	29	40	<0.001**
Poor Work and Productivity	NAID	3	6	9	0.02
	AID	9	50	59	<0.001**
Fatigue	NAID	19	11	30	0.59
	AID	22	76	98	<0.001**
Sore Tongue	NAID	0	1	1	0.13
	AID	4	18	22	<0.001**
Hair Loss	NAID	18	10	28	0.47
	AID	19	91	110	<0.001**
Leg Pains	NAID	20	10	30	0.78
	AID	20	68	88	<0.001**
Vertigo	NAID	1	0	1	1
	AID	7	16	26	<0.001**
Headache	NAID	17	3	20	0.04*
	AID	10	64	74	<0.001**
Pallor	NAID	6	10	16	0.002**
	AID	45	94	139	<0.001**

**P-value<0.001, *P-value<0.05, highly significant and significant at 5% level of significance (NAID-Non Anemic Iron Deficiency, AID-Anemic Iron Deficiency)

Table 4: Association between age group and ferritin levels

Complication		Hb Level				P-value
		Mild	Moderate	Severe	Very Severe	
Flattening Nails						
20-50	Absent	7	23	8	5	**0.04***
	Present	0	0	0	2	
< 20	Absent	9	44	19	14	**0.001****
	Present	0	0	2	6	
Postural hypotension						
20-50	Absent	7	23	8	6	0.31
	Present	0	0	0	1	
< 20	Absent	9	44	21	16	**0.004****
	Present	0	0	0	4	
Tachycardia						
20-50	Absent	7	23	7	4	**0.008****
	Present	0	0	1	3	
< 20	Absent	9	41	17	17	0.31
	Present	0	3	4	3	
Venous hum						
20-50	Absent	7	23	7	4	**0.008****
	Present	0	0	1	3	
< 20	Absent	9	44	21	20	**<0.001****
	Present	0	0	3	11	
Heart Failure						
20-50	Absent	7	23	8	6	0.31
	Present	0	0	0	1	
< 20	Absent	9	44	21	17	**0.02***
	Present	0	0	0	3	

**P-value<0.001, *P-value<0.05, highly significant and significant at 5% level of significance

Discussion

Iron Deficiency as a major cause of anaemia adds to the poor prognosis. Iron deficiency is prevalent even in patients without anaemia, signifying the importance of iron deficiency as a single poor prognostic factor in various diseases. In large clinical trials prevalence of anaemia ranges from 14 to 70% among hospitalised patients. Iron deficiency impairs the cognitive development of children from infancy through to adolescence and damages immune mechanisms and is associated with increased morbidity rates. During pregnancy, iron deficiency is associated with multiple adverse outcomes for both mother and infant, including an increased risk of haemorrhage, sepsis, maternal mortality, perinatal mortality, and low birthweight.

It estimated that nearly all women are, to some degree, iron deficient, that more than half of the pregnant women in developing countries suffer anemia. Even in industrialized countries, the iron stores of most women are considered to be deficient. Finally, as much as a 30% impairment of physical work capacity and performance reported in iron-deficient men and women. The economic implications of iron deficiency and of the various intervention to combat it suggest that food-based approaches and targeted are particularly cost-effective. The highest benefit-to-cost attained with food fortification. Iron status can be considered as a continuum from an

iron deficiency with anemia, to iron deficiency with no anemia, to normal iron status with varying amounts of stored iron, and finally to iron overload - which can cause organ damage when severe. Iron deficiency is the result of long-term negative iron balance. Iron stores in the form of haemosiderin and ferritin are progressively diminished and no longer meet the needs of average iron turnover.

In the present study patients who enrolled in the study will be divided under different age groups with and without signs and symptoms to quantify and qualify the presentation and diagnosis of iron deficiency and clinical spectrum, and laboratory tests among non-anemic patients. In the Present study serum ferritin of 20 to 50 ng/dl considered as a borderline low state- latent iron deficiency stage and levels < 20 ng/dl considered as an iron-depleted state. Among all total no. of nonanemic iron deficiency cases were 61; The maximum number of cases were in this group are in latent iron deficiency stage(n=42; 68.9%) when compared to the iron-depleted stage(n=19; 31.1%). And anemic iron deficiency cases are 139; The maximum number of cases in this group are grade 2 anemia (n=67; 48.2%) and minimum no. of cases are grade 1 anemia (n=16; 11.5%)

In 200 subjects, the incidence of hypoferritinemia is more in 20-39 years age group and 40-59 years age group, and incidence of latent iron deficiency is more in 20-39 age group and anemic iron deficiency in 20-39 and 40-59 age group. In 200 subjects, the incidence of severe hypoferritinemia is more in 20-39 and 40-59 age group with regular menstrual cycles when compared to borderline low ferritin levels.

The maximum number of hypothyroidism, hypertension and diabetes cases in the AID were 40, 22 and 27 respectively when compared to the NAID group 17, 10 and 27 respectively with maximum cases in severe hypoferritinemia in both groups.

Among Non-anemic Iron deficiency group it was observed that there was no statistically significant association between serum ferritin level and fatigue, poor work and productivity, sore tongue, hair loss, leg pains and vertigo but among anemic iron deficiency group there was statistically significant association between serum ferritin level and above mentioned parameters (P-value<0.001)

In the study done by Strauss WE et al.[4] and Houston BL et al.[5] sample size was 50 and 714 respectively, also showed a significant association between fatiguability, poor work productivity, Haemoglobin and ferritin levels. In another study done by Osaki T, et. Al[6] and Baird IM, et al.[7] showing a significant association between sore tongue, Haemoglobin, and ferritin levels in iron deficiency anemia patients, study done by Kantor, et al. (2003)and Rushton et. Al. (2002)showed a significant association between hair loss, Haemoglobin, and ferritin levels. One more study done by O'keeffe ST et.al and Lavan JN. et. al.[8] showed a significant association between leg pains, Haemoglobin and ferritin levels. Study done by Månsson J et al.[9] and Wood MM et.al.[10] showed a significant association between headache and vertigo, Haemoglobin and ferritin levels in an AID group. Study by Al-Sayes F et al.[11] and Suner S et al.,[12] showed a significant association between pallor and Haemoglobin levels in AID group.

Among the anemic iron deficiency group, similar to our observation study by Perera R et al. [13] showed a significant association between postural hypotension, ferritin and Haemoglobin levels in AID group P >0.05, another study done by Groom D, et al.[14] with sample size 84, age-15 yrs, the venous hum seen in 42 on the rt side showing a significant association between venous hum and Haemoglobin level. Study conducted by Szachniewicz et al. [15] and Komajda M et. al[16] showing

a significant association between heart failure and Haemoglobin levels.

In this study, the more common symptoms manifested in non anaemic iron deficiency which showed statistical significance are fatiguability and hair loss. So only a very few symptoms manifested in non anaemic iron deficiency group which mostly not showing any statistical significance. In anaemic iron deficiency group, many symptoms which manifested showed a statistical significance.

Conclusion

From overall observation and results and after discussion with other studies we can conclude that, two thirds of iron deficiency patients were in iron deficiency anemia group and one third of patients presented with non-anaemic iron deficiency group who presented with symptoms. So, one has to rely on non-hematologic symptoms also and interpret the ferritin concentration in conjunction with symptoms taking into consideration the differential diagnostic possibilities which may give similar symptoms and to correct the early stages of iron deficiency. When the patient is symptomless, he/she should be followed for an extended period of time to ascertain that the ferritin concentration remains stabilized.

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