Clinical and Biochemical Profile of Patients with Iron Deficiency Anemia at a Tertiary Care Hospital

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Abstract

Introduction: Iron deficiency anemia (IDA) is the most common cause of anemia worldwide, especially in adolescent girls, women of reproductive age group, and young children. The clinical presentation and the other biochemical parameters differ in a different age, sex, and geographical group. A study to evaluate the clinical and biochemical profile of patients with IDA at a tertiary care hospital. **Materials and Methods:** One hundred and two Cases of IDA were taken from the outpatient department (OPD) and ward. After taking consent, the workup was done. Complete history and physical examination were done, and patients were evaluated for signs and symptoms of IDA. Laboratory investigations such as complete blood count with differential count, reticulocyte count, peripheral blood smears, serum iron, total iron binding capacity, serum ferritin, lactic dehydrogenase, stool for occult blood and ova, cysts, liver and renal function were done in all the patients. **Results:** One hundred and two patients of IDA were enrolled from OPD and ward. The majority of the patients were from the 21 to 30 years age group (25.5%). 37.3% were male and 62.7% were female patients. The main presenting complaint was weakness and easy fatigability (91%). Among the associated comorbidities, the most common were hypertension (13.7%). The majority of the patients had severe pallor (54.9%). Icterus was found in 1.9%. Splenomegaly was found in 4.9%. General blood pictures showed 97.1% had microcytes, 96.1% had hypochromasia and 97.1% had Anisocytosis, which is characteristic of IDA. **Conclusion:** The majority of patients came to the hospital after developing clinical features due to severe anemia. Therefore, a population based study to evaluate the mild form of IDA or to evaluate a preanemic iron deficiency state can help in the early diagnosis of these patients before they develop severe form.

Keywords: Ferritin, iron deficiency anemia, menorrhagia

INTRODUCTION

Iron deficiency anemia (IDA) occurs when iron deficiency is sufficiently severe to reduce erythropoiesis. Worldwide, IDA is the most frequent chronic anemia. IDA is the most common cause of anemia worldwide, especially in adolescent girls, women of reproductive age group, and young children.[1-4] IDA has an alarming prevalence rate among pregnant women that is 88% and 74% prevalence in nonpregnant.[5] In the USA, 5%–12% of nonpregnant women and 1%–5% of men have IDA.[6] In our country, there is a high prevalence of IDA, particularly among women (as per the National Family Health Survey 2015–2016, 53% of all women are anemic).[7] According to a district level household survey conducted during 2002–2004 on reproductive and child health in India, 99% of adolescent girls had anemia and 19% of them were mildly anemic, 53% were moderately anemic and 28% had severe anemia.[8] In a study done by Twara *et al.*, in Motihari town of Bihar, the prevalence of anemia in adolescent girls was found to be 66%.[9] Iron deficiency may be the result of either excessive loss or, less frequently, decrease absorption.[10-12] Iron deficiency does not occur *de novo* in adults or children. There are several biochemical alterations that happen before the person develops frank anemia in iron deficiency. The clinical presentation and the other biochemical parameters differ in a different age, sex, and geographical group. Hence, it is very important to look for the clinical and biochemical profile of patients with IDA.

Access this article online

Quick Response Code:

Website:
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DOI:
10.4103/ami.ami_65_20

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How to cite this article: Kumar A, Bharti A, Meena LP, Tilak V. Clinical and biochemical profile of patients with Iron deficiency anemia at a tertiary care hospital. Acta Med Int 2020;7:153-7.

Objectives

The study is to evaluate the clinical and biochemical profile of patients with IDA at a tertiary care hospital.

MATERIALS AND METHODS

This cross-sectional observational study was conducted at the department of general medicine with the collaboration of the Department of Pathology in the Institute of Medical Sciences, Banaras Hindu University, India. One hundred and two Cases of IDA were taken from the outpatient department (OPD) and ward. The study was approved by the ethical committee of the institute (No. Dean/2018/EC/314). Written consent was obtained from all the patients. Name and other identities were not disclosed anywhere in the study. Inclusion criteria – Age >18 years, Patient of IDA with hemoglobin <11 g/dl. Exclusion criteria – Age <18 years, patient who does not give consent, microcytic hypochromic anemia other than IDA. Complete history and physical examination were done and patients were evaluated for signs and symptoms of IDA. Laboratory investigations such as-complete blood count (CBC) with differential count, reticulocyte count, peripheral blood smears, serum iron, total iron binding capacity (TIBC), ferritin, lactic dehydrogenase (LDH), stool for occult blood and ova, cysts, liver and renal function were done in all the patients. CBC was done in Correct Coding Initiative laboratory of the pathology department who uses 5 part differential fully automated Mindray hematology analyzer. Serum Iron and serum LDH were estimated by colorimetric assay, serum TIBC, and serum ferritin by photometric assay, serum total protein, and albumin by colorimetric assay, serum creatinine by spectrometric assay, and urea by spectrophotometric assay. Stool for occult blood was measured by using the Guaiac method.

Statistical analysis

Data were extracted and analyzed using SPSS software version 16.0 (SPSS Inc., Chicago, IL, USA). The data were presented as mean ± standard deviation for continuous variables and frequency with their respective percentages for categorical variables. Patient characteristics were described in terms of the median. For categorical data, Chi-square test and Fischer exact test were used and for continuous data Student's *t*-test.

RESULTS

One hundred and two Patients of IDA were enrolled from OPD and ward. The selected population for the study was age ≥18–80 years. The majority of the patients were from the 21 to 30 years group (25.5%). About 37.3% were male and 62.7% were female patients. By occupation, the majority of females were home makers, followed by students, businessmen, unemployed, farmer, laborer, and other government employees [Table 1]. The main presenting complaint was weakness and easy fatigability (91%) followed by hemorrhoid (31.4%), and menorrhagia (23.6%). Other symptoms include per rectal bleed, dyspnea on exertion in

Table 1: Age, sex and occupation of the study population

	Frequency (%)
Age group (years)	
18-20	7 (6.9)
21-30	26 (25.5)
31-40	14 (13.7)
41-50	13 (12.7)
51-60	20 (19.6)
61-70	18 (17.6)
71-80	4 (3.9)
Sex	
Male	38 (37.3)
Female	64 (62.7)
Occupation	
Housewife	48 (47.1)
Student	19 (18.6)
Businessman	13 (12.7)
Unemployed	9 (8.8)
Farmer	8 (7.8)
Government employee	3 (2.9)
Laborer	2 (2.0)

Malena, generalized body swelling, pain abdomen, multiple joint pain, Rashes over the body, and other less common features, as described in Table 2. Among the associated comorbidities, the most common were hypertension (13.7%) followed by diabetic, hypothyroid, tuberculosis, coronary artery disease, and others, as described in Table 3. Few patients had multiple comorbidities; most common were diabetes and hypertension. About 62.70% of studied patients were vegetarian and 37.3% were consuming a mixed diet. Four (3.9%) had a history of the posterior inferior cerebellar artery (PICA), 61.8% had a history of blood transfusion, 35.3% had a history of hematinics intake, and 2.9% had nonsteroidal antiinflammatory drugs intake for a long period. On clinical examination, the majority of the patients had severe pallor (54.9%). Icterus was found in 1.9%. Splenomegaly was found in 4.9%, hepatomegaly in 2.9%. Other changes found in our study were angular cheilitis and nail changes [Table 4]. Digital rectal examination and proctoscopy were done in 62 out of 102 patients, 34 patients (33.3%) had hemorrhoid (includes Grades I, II, II with one or more than one columns), 25.5% had no abnormal findings and 0.98% had an anal fissure. 89.2% of patients had hemoglobin <8 g/dl and 10.8% had 8–10 g/dl (normal range13–16 g/dl). Platelet count was 1.5–4 lac/Cu.mm (normal range 1.50–4.50 lac/Cu.mm) in 74.5% in the majority of the patients [Table 5]. The mean hemoglobin in male patients was 5.4 ± 1.4 and in female patients was 5.99 ± 2.01. Mean red cell distribution width in males was 20.6 ± 2.85 and in the female, it was 19.8 ± 3.06. The mean serum LDH level in males was 268.1 ± 91.37 and in the female, it was 287.30 ± 219.77. The mean serum iron was 18.29 ± 7.69 for males and 22.92 ± 9.64 for females, mean TIBC was 499.34 ± 134.51 in male and 487.14 ± 101.6 in female [Table 6]. General blood pictures (GBPs) showed 97.1% had microcytes, 96.1% had hypochromasia and 97.1%

Table 2: Presenting symptoms/complaints

Symptoms	Frequency (%)
Weakness and easy fatigability	91 (89.2)
Hemorrhoid	32 (31.4)
Menorrhagia	15 (23.4)
Per rectal bleed	22 (21.6)
Dyspnea on exertion	19 (15.8)
Malena	10 (9.8)
General body swelling	8 (7.8)
Pain abdomen	6 (5.9)
Multiple joint pain	4 (3.92)
Burning micturition	2 (1.96)
Cough with sputum production	2 (1.96)
Rashes over body	2 (1.96)
Fever	2 (1.96)
Palpitation	1 (0.98)
Loose motion	1 (0.98)
Jaundice	1 (0.98)
Sensitivity to gluten diet	1 (0.98)
Per vaginal bleed	1 (0.98)
Dysmenorrhea	1 (0.98)
Prolapsed uterus	1 (0.98)

Table 3: Comorbidities

Comorbidities	Frequency (%)
Hypertension	14 (13.73)
Diabetes mellitus	7 (6.86)
Hypothyroidism	3 (2.94)
Tuberculosis	3 (2.94)
Coronary artery disease	2 (1.96)
Congestive heart failure	2 (1.96)
Chronic obstructive pulmonary disease	2 (1.96)
Cerebrovascular accident	2 (1.96)
Rheumatoid arthritis	2 (1.96)
Carcinoma cervix	1 (0.98)
Chronic kidney disorder	1 (0.98)
Chronic myeloid leukemia	1 (0.98)
Hepatitis C virus	1 (0.98)
Hemophilia	1 (0.98)
HIV	1 (0.98)
Hodgkin's lymphoma	1 (0.98)
Interstitial lung disorder	1 (0.98)
Systemic lupus erythmatus	1 (0.98)
Spondyloarthropathy	1 (0.98)
Thalassemia	1 (0.98)
Valvular heart disease	1 (0.98)

Table 4: Examination findings

	Frequency (%)
Pallor	
Mild	13 (12.7)
Moderate	33 (32.4)
Severe	56 (54.9)
Icterus	2 (1.96)
Per abdomen	
Splenomegaly	5 (4.9)
Hepatomegaly	3 (2.9)
Hepatosplenomegaly	2 (1.96)
Nail changes	
Koilonychia	2 (1.96)
Brittle nail	5 (4.9)
Platynychia	11 (10.8)
Other epithelial changes	
Angular chelitis	7 (6.9)

Table 5: Complete blood count

	Frequency (%)
Hb	
<8	91 (89.2)
8-10	11 (10.8)
>10	
Platelet count	
<1.5	14 (13.7)
1.5-4	76 (74.5)
>4	12 (11.8)

Hb: Hemoglobin

had anisocytosis, which is characteristic of IDA [Table 7]. Other findings in GBP include target cells in 32.3%, schistocytes in 39.2%, and few macrocytes in 10.7% of the patients. Bone marrow examination was done in only 5 patients and out of these, 2 had grade zero pearl's stain, 1 had grade1 pearl's stain and 2 had grade 2 pearl's stain. Grade zero pearl's stain has no iron store. Stool for occult blood was done in the majority of patients (95.1%) and before documenting it negative three samples of stool were send. Stool for occult blood was positive in 33.3% of patients in the 1st sample, 2.9% in the 2nd sample, and 1.96% in the 3rd sample. Ova and cyst were present in 16 of the total sample send. Of these, 10.8% had hookworm and 4.9% had Ascaris lumbricoides.

DISCUSSION

Iron deficiency is the most common hematological disorder, and IDA is the most common cause of anemia worldwide.[13] The mean age of participants in our study was 43.6 years, and the median was 44.5 years, but the majority of the anemic patients were in the age group 21–30 years. However, in a study done by Kumari *et al.*, the most commonly affected age group was 0–20 years.[14] This difference in the observation among the two studies may be because the present study has taken patients of IDA only above the age of 18 years. Maximum studied patients belonged to the reproductive age group. Females in the reproductive age group require more iron and also prone to develop IDA due to the loss of blood during menstruation. In females of the reproductive age group, menorrhagia was also a leading cause of IDA.[15] As shown in Table 1, the second most common age group is the age of 51–60 years. The elderly age group incidence of IDA was more because of the lesser intake of iron and losses of blood

Table 6: Iron and lactate dehydrogenase profile

	Male (*n*=38)	Female (*n*=62)
Fe	18.29±7.69	22.92±9.64
	t=−2.520, *P*=0.013 (S)	
TIBC	499.34±134.61	487.14±101.60
	t=0.518, *P*=0.605	
Transferrin saturation	4.76±7.06	4.92±2.32
	t=−0.167, *P*=0.867	
Ferritin	13.732±6.80	13.089±7.01
	t=0.452, *P*=0.652	
LDH	268.18±91.37	287.30±219.77
	t=−0.510, *P*=0.611	

LDH: Lactate dehydrogenase, TIBC: Total iron binding capacity, S: Significant

Table 7: General blood picture findings/bone marrow pearls stain

	Frequency (%)
GBP findings	
Microcytes	99 (97.1)
Hypochromasia	98 (96.1)
Anisocytosis	99 (97.1)
GBP other findings	
Target cells	33 (32.3)
Schistocytes	40 (39.2)
Macrocytes	11 (10.7)
Bone marrow pearl stain	
Grade zero	2 (2)
Grade1	1 (1)
Grade2	2 (2)
Not done	97 (95.1)

GBP: General blood picture

from the gastrointestinal tract (hemorrhoids, malignancies). This study shows a preponderance of female patients (64 out of 102 patients). These findings are similar to some other studies.[16,17] Other studies have shown a slightly more prevalence among males compared to females.[18,19] The WHO also says that 30% of nonpregnant and 42% of the pregnant female have anemia and a majority of them belongs to IDA. As per the National Family Health Survey 2015–2016, 53% of all women in India were anemic.[7] As observed in our study, a total of 15 (14.8% of total patients and 23.4% of the total female patients) out of 64 female patients had menorrhagia. Hence, it is one of the major causes of IDA. Among the occupation of the cases, the majority belonged to the housewife group, followed by students. The most common presenting complaint was generalized weakness and easy fatigability, which was present in 89% of studied patients. Many other studies also had more similar observations compared to the present study.[16,19,20] On clinical examination, we also got some characteristic findings of IDA. 1.96% of patients develop Koilonychia. It is primarily recognized as a manifestation of chronic iron deficiency.[21] Splenomegaly was found in 4.9%, Hepatomegaly in 2.9%. Splenomegaly may occur with severe, persistent, untreated

IDA.[22] In this study, IDA was more commonly seen in patients who were vegetarian by diet as compared to mix diet. About 3.9% of our studied patients had a history of PICA. On further investigation, all of these patients have worm infestation also. Worm infestation was also one of the major causes of IDA. Among worm infestation, hookworm infestation is the most common worldwide and it is a common cause of occult gastrointestinal bleeding and anemia.[23,24] Each worm can suck about 0.1–0.4 ml blood/day, which may reach >250 ml/day in cases of heavy worm infestation and leads to IDA. The mean hemoglobin was 5.4 ± 1.4 and 5.99 ± 2.01 in males and females, respectively. Because the majority of the patients come to the hospital after developing symptoms., mean red cell distribution width in males was 20.6 ± 2.85 and 19.8 ± 3.06 in males and females, respectively, which is a typical finding of IDA. The mean serum LDH level was within the normal limit, which suggests that most of the patients develop IDA due to some benign causes because, in most of the malignancy, the LDH level is usually raised. GBPs showed 97.1% had microcytes, 96.1% had hypochromasia, and 97.1% had anisocytosis, which is characteristic of IDA. Decreased iron stores inhibit the production of hemoglobin chains, and its concentration starts to decrease in the newly formed red blood cells (RBCs), since the red color of RBCs is due to hemoglobin the color of the newly formed RBCs starts to fade thus, they become hypochromic. Due to less amount of hemoglobin, the newly produced RBCs remain small in size when compared to normal RBCs.[25]

Conclusion

The most common age group affected by IDA is the younger group and females were found more affected than males. The majority of patients came to the hospital after developing clinical features due to severe anemia. Therefore, a population-based study to evaluate the mild form of IDA or to evaluate a preanemic iron deficiency state can help in the early diagnosis of these patients before they develop severe form.

Conflicts of interest
There are no conflicts of interest.

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