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Original Research Article

Evaluation of anaemia

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ABSTRACT

Background: Often, the first test used to diagnose anemia is a complete blood count (CBC). It determines the number, size, volume, and hemoglobin content of red blood cells. Peripheral smear is done for typing of anaemia. Such evaluation is necessary for proper treatment.
Methods: A retrospective study was done in 300 anaemic patients at Shakuntala pathology laboratory, Nagpur. Patients were randomly selected including males and females. CBC and peripheral smear were analyzed.
Results: Out of total 300 patients evaluated, the prevalence of anaemia was quite significant in females 225 (75%) than males 75 (25%). 66 females (22%) had mild anemia while 129 females (43%) had moderate anemia and 30 females (10%) had severe anaemia 36 males (12%) had mild anaemia, 30 males (10%) had moderate anaemia while 9 males (3%) had severe anaemia. In morphology of red blood cells, normocytic normochromic anaemia was seen in 132 (44%) females and in 45 (15%) of males. Microcytic hypochromic anaemia was seen in 90 (30%) females and 27 (9%) males. Macrocytic anaemia was seen in 3 (1%) females and 3 (1%) males.
Conclusions: Prevalence of anaemia is quite high in females than males. Also, the severity of anaemia is more in females than males. So, heath programmes should be directed more towards females since adolescent age.

Keywords: Anaemia, Complete blood count, Peripheral smear

INTRODUCTION

Anemia is a public health issue for developing countries, especially for child bearing women.[1] The worldwide prevalence of anemia in child bearing age group is quite high (30.2%).[1]

The foundation of laboratory hematologic diagnosis is the complete blood count and review of the peripheral smear. In patients with anemia, the peripheral smear permits interpretation of diagnostically significant red blood cell (RBC) findings. These include assessment of RBC shape, size, color, inclusions, and arrangement. Abnormalities of RBC shape and other RBC features can provide key information in establishing a differential diagnosis.[2]

The laboratory evaluation of anemia begins with a complete blood count and reticulocyte count. The anemia is then categorized as microcytic, macrocytic or normocytic, with or without reticulocytosis. Examination of the peripheral smear and a small number of specific tests confirm the diagnosis. The serum iron level, total iron-binding capacity, serum ferritin level and hemoglobin electrophoresis generally separate the microcytic anemias.[3]

According to data from the world health organization and UNICEF from year 2009, iron deficiency is the most widespread nutritional deficiency worldwide. This deficiency causes an imbalance between needs and iron supply, which consequently results in anemia. Around the

world, two million people suffer from anemia, half of which is due to iron deficiency. The most impacted groups are children and teenagers.[4]

In approximately 2 to 4 percent of patients, laboratory evidence of macrocytosis is found.[5] A blood smear should be performed to differentiate the two forms. Neutrophil hyper segmentation is one of the most sensitive and specific signs of megaloblastic anemia.[5]

Screening is recommended only for high-risk children. Anemia is classified as microcytic, normocytic, or macrocytic, based on the mean corpuscular volume. Mild microcytic anemia may be treated presumptively with oral iron therapy in children six to 36 months of age who have risk factors for iron deficiency anemia. If the anemia is severe or is unresponsive to iron therapy, the patient should be evaluated for gastrointestinal blood loss.[6]

Normocytic anemia may be caused by chronic disease, haemolysis, or bone marrow disorders. Workup of normocytic anemia is based on bone marrow function as determined by the reticulocyte count. If the reticulocyte count is elevated, the patient should be evaluated for blood loss or haemolysis. A low reticulocyte count suggests aplasia or a bone marrow disorder.[6]

In the vast majority of cases, the cause of microcytic hypochromic anemia is clearly suggested by the patient history, physical examination results, red cell indexes, and peripheral blood smear.[7]

When the underlying cause of anemia is obscure, the serum ferritin concentration should be measured first. If it is normal or increased, serum iron and free erythrocyte protoporphyrin levels can be determined. The serum iron level is low in anaemias caused by iron deficiency and chronic disease but normal or elevated in those resulting from the thalassemias.[7]

Although many sophisticated tests have been devised for the diagnosis of iron deficiency the most reliable criterion of iron deficiency anemia is the hemoglobin response to an adequate therapeutic trial of iron. Following the reticulocytosis peak hemoglobin rises at an average of 0.25 to 0.4 g/dl/day and haematocrit at a rate of 1% per day. If the response to iron falls short of this response other causes of the anemia should be sought by detailed hematologic investigation. In addition to making a diagnosis of iron deficiency anemia it is incumbent on the physician to demonstrate its cause.[8]

The world health organization recently reported that 1.62 billion of the world population is anaemic. The rate among students is 25.4% and in preschool age children anemia reaches its highest percentage of 47.4. Iron deficiency anemia accounts for 75% of all types of anemia in the third world, affecting 30% of population.[3] In females of childbearing age, the most frequent cause of iron-deficiency anemia is loss of iron in blood due to significant menstruation or pregnancy. Iron-deficiency anemia can also be caused by a poor diet or by certain intestinal diseases that affect how the body absorbs iron. The condition is normally treated with iron supplements.[9]

Iron deficiency anaemia occurs at all stages of the life cycle, but is more prevalent in pregnant women and young children. Adolescents, especially girls, are particularly vulnerable to iron deficiency. The highest prevalence is between the ages of 12-15 years when requirements are at a peak.[10]

Methods

A secondary analysis of 300 patients found to be anaemic was carried out including haematocrit, mean corpuscular volume (MCV), mean corpuscular hemoglobin (MCH), and mean corpuscular hemoglobin concentration (MCHC).

The cut-off value for the determination of anemia was defined as blood Hb <13 g/dl in males and <12 g/dL in females. The analysis was done on day-to-day basis and the results were saved in excel sheets for further analysis.

The severity of anemia was classified into three stages:

- Mild- 11-11.9 g/dL in females and 11-12.9 g/dl males
- Moderate- 8-10.9 g/dL in males and females
- Severe- Hb < 8 g/dL in males and females.

On the basis of RBC indices, an anemia with MCV <80 fL was classified as microcytic:

- MCV >96 as macrocytic anaemia
- MCH <27 as hypochromic anemia
- MCHC<32 was considered significant.

Haematocrit of < 41% in males and < 36% in females was considered significant. Peripheral smear was done and according to morphology of red blood cells, anaemia was classified as-

- Normocytic normochromic
- Microcytic hypochromic
- Macrocytic

The data was stored and analysed on Microsoft Excel 2007.

RESULTS

Table 1: Sex distribution.

Sex distribution	Total number	Percentage
Males	75	25%
Females	225	75%

In present study, out of total 300 patients evaluated, number of males was 75 (25%). Total number of anaemic females was 225 (75%). So, the prevalence of anaemia was quite significant in females 225 (75%) than males 75 (25%).

Table 2: Age distribution.

Age group	No. of females	Percentage	No. of males	Percentage
<18 years	24	8	15	5
18-50 years	117	39	36	12
>50 years	84	28	24	8

In present study, 24 (8%) females were below 18 years of age, 117 females (39%) were between 18-50 years while 84 (28%) females were of >50 years. In present study, 15 (5%) males were below 18 years of age, 36 (12%) males were between 18-50 years while 24 (8%) males were of >50 years.

Table 3: Severity of anemia.

Type of anaemia	No. of females	Percentage	No. of males	Percentage
Mild anaemia	66	22 %	36	12%
Moderate anaemia	129	43 %	30	10%
Severe anaemia	30	10 %	9	3%

Out of 300 patients, 66 females (22 %) had mild anemia while 129 females (43 %) had moderate anemia and 30 females (10 %) had severe anaemia, 36 males (12%) had mild anaemia, 30 males (10%) had moderate anaemia while 9 males (3%) had severe anaemia. Majority of females had moderate anaemia while majority of males had mild anaemia.

Table 4: Red cell indices.

Red cell indices	No. of females	Percentage	No. of males	Percentage
RBC count	135	45%	54	18%
Haematocrit	210	70%	57	19%
MCV	132	44%	36	12%
MCH	153	51%	33	11%
MCHC	141	47%	36	12%

Table 5: Peripheral smear.

Peripheral smear	No. of females	Percentage	No. of males	Percentage
Normocytic normochromic	132	44%	45	15%
Microcytic hypochromic	90	30%	27	9%
Macrocytic	3	1%	3	1%

In present study, hematocrit was better predictor of anaemia. It was significantly less in 210 (70%) of females and 57 (19%) of males. RBC count was less in 135 (45%) of females and 54 (18%) of males.

- MCV was less in 132 (44%) females and 36 (12%) males.
- MCH was less in 154 (51%) females and 33 (11%) males.
- MCHC was less in 141 (47%) females and 36 (12%) males.

In present study, in morphology of red blood cells, normocytic normochromic anaemia was seen in 132

(44%) females and in 45 (15%) of males. Microcytic hypochromic anaemia was seen in 90 (30%) females and 27 (9%) males. Macrocytic anaemia was seen in 3 (1%) females and 3 (1%) males.

DISCUSSION

In present study, out of total 300 patients evaluated, number of males was 75 (25%). Total number of anaemic females was 225 (75%). So, the prevalence of anaemia was quite significant in females than males.

In present study, 24 (8%) females were below 18 years of age, 117 females (39%) were between 18-50 years while 84 (28%) females were of >50 years. In present study,15 (5%) males were below 18 years of age, 36 (12%) males were between 18-50 years while 24 (8%) males were of >50 years. N Nasir Al reported that a total of 268 female students were incorporated in this research; age range 20-31 years with a mean of 24.5 years. 171 (64%) students were found to be anemic. The mean Hb concentration was 9.8±7 g/dL with a range from 5.7 to 17.4 g/dL. 41% students from the education college, 40% from the science college and 39% from the medical college were reported to have hemoglobin <12 g/dL.[9]

In present study, out of 300 patients, 66 females (22 %) had mild anemia while 129 females (43 %) had moderate anemia and 30 females (10 %) had severe anaemia 36 males (12%) had mild anaemia, 30 males (10%) had moderate anaemia while 9 males (3%) had severe anaemia. Majority of females had moderate anaemia while majority of males had mild anaemia.

N Nasir Al reported that the overall prevalence of mild (10-11 g/dL), moderate (7-10 g/dL), and severe (Hb <7 g/dL) anemia was 45%, 49%, and 6%, respectively.[9] N Nasir Al reported that 171 (64%) students were found to be anemic. The overall prevalence of mild (10-11 g/dL), moderate (7–10 g/dL), and severe (Hb <7 g/dL) anemia was 45%, 49%, and 6%, respectively. Out of the anemic students, 81% showed microcytic (MCV <80 fL) and 1.6% had macrocytic (MCV >96 fL) variety.[9]

WHO South East Asia published that in all member states of the South-East Asia region, except Thailand, more than 25% of adolescent girls are reported to be anaemic; in some countries, the prevalence is as high as 50%.[10] Bentley ME et al found that prevalence of anemia was high among all women. In all 32.4% of women had mild (100-109.99 g/l for pregnant women, 100-119.99 for non-pregnant women), 14.19% had moderate (70-99.99 g/l), and 2.2% had severe anemia (<70 g/l). Poor urban women had the highest rates and odds of being anemic. 52% of thin, 50% of normal BMI, and 41% of overweight women were anemic.[11] Eckhardt CL found that more than half of the women were overweight in all three countries and the prevalence of overweight reached 77% in Egypt. Anaemia prevalence was similar across countries (28, 31 and 23% in Egypt, Peru and Mexico respectively). In Egypt, Overweight women had significantly lower odds of anaemia than non-overweight women (OR=0.78, 95% CI: 0.68, 0.90).

Similar results were found in Peru, but the difference was smaller in magnitude (OR=0.83, 95% CI: 0.71, 0.96). In Mexico, there were no differences in the odds of anaemia by BMI group.[12] A cross-sectional study conducted in Riyadh City by A.O. Musaiger among school girls showed that the prevalence was 40.5% among female adolescents (16-18) years old.[13] Sultan AH found Emirati college students with a measured mean Hb of 12.3 g/dL. In that study, the overall estimated sample prevalence of anemia (Hb <12 g/dL) was 26.7%.[14] Chaudhary S et al reported that out of 296 subjects, 104 (35.1%) subjects were found to be anemic. Out of 104 subjects, 72 subjects (69.2%) had mild anemia (Hb 10 to < 12 gm%) while 32 subjects (30.8%) had moderate anemia (Hb 7 to < 10 gm%). None of the subjects had severe anemia.[15]

In present study, hematocrit was better predictor of anaemia. It was significantly less in 210 (70%) of females and 57 (19%) of males. RBC count was less in 135 (45%) of females and 54 (18%) of males. MCV was less in 132 (44%) females and 36 (12%) males. MCH was less in 154 (51%) females and 33 (11%) males. MCHC was less in 141 (47%) females and 36 (12%) males.

In present study, in morphology of red blood cells, normocytic normochromic anaemia was seen in 132 (44%) females and in 45 (15%) of males. Microcytic hypochromic anaemia was seen in 90 (30%) females and 27 (9%) males. Macrocytic anaemia was seen in 3 (1%) females and 3 (1%) males. Suarez T et al found that prevalence of anemia was 78% and for iron, folic acid and vitamin B12 deficiencies were 34.66, 90.9 and 18.18%, respectively. From anemic cases, 35.89% presented iron deficiency, while 91.02% presented folic acid deficiency. Only 19.23% of adolescents with anemia presented also vitamin B12 deficiency, but all the cases with vitamin B12 deficiency, were anemic. Simultaneous iron and folic acid deficiencies affected 30.76% of anemic cases.[16]

Friedman AJ suggested that if the patient does not fit the diagnosis of IDA or fails to respond to a trial of oral iron, or mean corpuscular volume is elevated, further diagnostic evaluation is needed, including iron studies, B12, folate levels, and renal function tests. If results are not definitive, and IDA persists, a hematology referral is recommended.[17] Rogan DL et al found that of 1358 children aged 9 to 36 months who underwent screening, 343 (25%) had anemia, defined as a Hb level of less than 110 g/L. Outpatient medical records of 334 of the anemic children revealed that 239 (72%) were prescribed iron while 95 (28%) were not prescribed iron at the first visit for anemia. Anemia follow-up rates were low for the prescribed and not prescribed groups: 7% versus 5% returned within 1 month, while 37% versus 42% did not return within 6 months for follow-up. Of the children

who were prescribed iron, 107 (71%) of 150 responded to treatment or anemia resolved within 6 months compared with 27 (68%) of 40 not prescribed iron.[18]

CONCLUSION

Anaemia is still a major problem more so in females. Severity is also more in females. So, health programs targeting public awareness to improve the health and nutritional status of the men and women should be implemented to focus on the improvement of nutritional habits and quality and quantity of the diet. Clinicians should routinely identify and treat iron deficiency anaemia, thereby decreasing its negative impact on health and quality of life of women.

Recommendations

Further analysis of anaemia should be done. Haemoglobin electrophoresis and Hemoglobin A2 levels should be done. Also, routine deworming should be done.

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