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A Study of Red Cell Distribution Width and RBC Indices in Iron Deficiency Anemia

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Abstract

Background: Iron deficiency anemia (IDA) is the most prevalent micronutrient deficiency in the world. The etiological method of classification involves anemias due to impaired red cell production, hemolytic anemia due to increased red cell destruction and anemia due to blood loss in cases of trauma or injuries. In Indian anemia affects females (9.9%) more than males (7.8%). **Subjects and Methods:** This was a retrospective type of study in which we evaluated 100 cases of microcytic anemia. The primary objective of this study was to explore the role of red cell distribution width (RDW) in diagnosing iron deficiency anemia (IDA). The cut off point for hemoglobin (Hb), MCV, RDW and serum ferritin were taken according to normal reference ranges for both sexes and different age groups, from Dacie and Lewis Practical Haematology. **Results:** Amongst data of 62, maximum number of females have their hemoglobin in the range of 10-9.1 and amongst data of 38 males, maximum number of males have their hemoglobin in the range of either 7-6.1 or 5-2. Microcytic hypochromic anemia was seen in 17 out of 100 anemic patients. Its common causes are iron deficiency, sideroblastic, chronic disease, inflammation, lead poisoning and thalassemia trait. Normochromic normocytic anemia was recorded in 56 patients among them 37 subjects were females while 19 subjects were males. Hyperchromic anemia was observed in 9 patients (5 females and 4 males). **Conclusion:** Present study underlined the importance and role of RDW in diagnosis of iron deficiency anemia. In a scenario of high prevalence of anemia in our country and even higher costs of specialized tests, the need to adopt cost effective, accurate and efficient measures is required. Since different etiologic factors result in characteristically different red cell morphology, the clinician can properly plan the management of a patient with an anemia if the blood counts are interpreted according to red cell indices.

Keywords: Red cell Distribution Width, Iron Deficiency Anemia, Haemoglobin.

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Introduction

Iron deficiency anemia (IDA) is the most prevalent micronutrient deficiency in the world.[1] Anemia is a major public health problem in developing countries.[2,3] The multitude of clinical presentations and pathogenesis makes the evaluation of anemias, ever challenging and significant. 2 Anemia may be defined as a reduction in the concentration of Hb which leads to reduced oxygen carriage and delivery that leads to symptoms such as shortness of breath, exertion, tiredness, headache, or angina if anemia is severe of rapid onset and in elderly.[4,5]

It can also be termed as reduction of more than 10% from the normal value of total number of red blood cells, amount of circulating hemoglobin and RBC mass of a particular patient. 6 Conventionally anemia is said to be decrease in RBC, hemoglobin and hematocrit below the previously established normal values for healthy persons of the same age, gender and race and under similar environment conditions. Its clinical diagnosis is made from the history, physical examination, signs and symptoms, hemoglobin values and other procedures and findings. Functionally, it is said to be the decrease in the oxygen carrying capacity of the blood which leads to tissue hypoxia. Morphologically anemia can be classified as microcytic hypochromic anemia which characteristically shows reduced MCV (mean corpuscular volume) values (<80fl) as well as reduced MCHC (mean corpuscular hemoglobin concentration) values (30gm/dl), normocytic normochromic which has normal MCV (82-100 FL) values, macrocytic hypochromic anemia which shows characteristic increased MCV values (>100fl) and normal MCHC. The etiological method of classification involves anemias due to impaired red cell production, hemolytic anemia due to increased red cell destruction and anemia due to blood loss in cases of trauma or injuries. In Indian anemia affects females (9.9%) more than males (7.8%).[7-12]

The present study was undertaken to evaluate RDW as a screening test for diagnosis of iron deficiency anemia.

Subjects and Methods

This was a retrospective type of study which was carried out at Medicine Department of ESIC Medical College & PGIMSR, Chennai From July 2017 to June 2018. Present study included 100 anaemic patients having haemoglobin

<10 gm%. The study population was divided into two group females group and males group.

The sample size was obtained from collecting data from 100 anaemic (<10gm% hemoglobin) patients. The hypothesis of the project was that red cell indices and platelet count help in morphological classification of anemia in patients with hemoglobin less than 10gm%.

Inclusion criteria for the patients were hemoglobin below 10gm%, age between 20-40 years, either sex and patients giving permission to use their haemogram report for the observational study purpose.

Exclusion criteria for the participants were patients with history of chronic illness, heart disorders and kidney disorders etc and patients having hemoglobin above 10gm%.

This was a retrospective type of study in which we evaluated 100 cases of microcytic anemia with reduced mean corpuscular volume (MCV <80 fl), referred by different clinicians to a diagnostic setup. The primary objective of this study was to explore the role of red cell distribution width (RDW) in diagnosing iron deficiency anemia (IDA). The cut off point for hemoglobin (Hb), MCV, RDW and serum ferritin were taken according to normal reference ranges for both sexes and different age groups, from Dacie and Lewis Practical Haematology. The Hb concentration, MCV and RDW values in all cases were obtained by automated haematology analyzer.[13,14]

Results

Amongst data of 62, maximum number of females have their hemoglobin in the range of 10-9.1 and amongst data of 38 males, maximum number of males have their hemoglobin in the range of either 7-6.1 or 5-2.

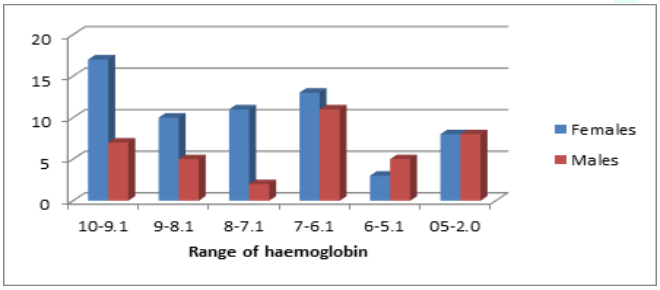

Figure 1: Comparison of various ranges of haemoglobin in different participants

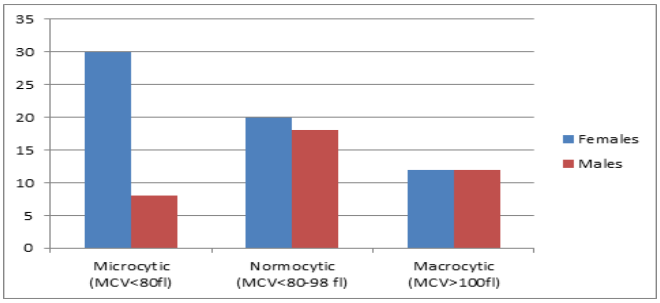

Figure 2: Classification according to morphology

In females, microcytic anemia was seen in maximum (30 females) as cause of microcytic anemia was most commonly iron deficiency and females in India are highly prone to iron deficiency anemia and in males normocytic anemia was seen in maximum (18 males).

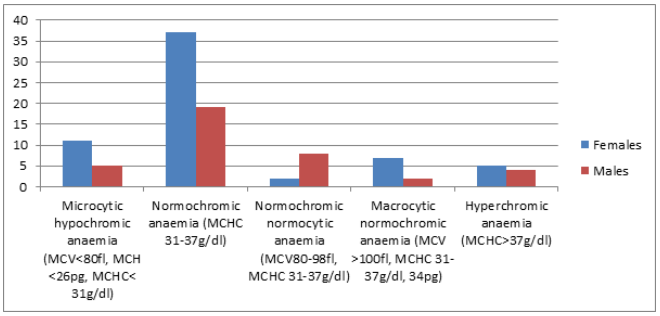

Figure 3: Distribution of population according to size and shape

Most common cause of normochromic anemia was acute blood loss, as females suffer from acute blood loss during labor process of delivering a child and adolescent girls experience menstruation, maximum number of females have shown normochromic anemia. Other causes of normochromic anemia are hereditary spherocytosis, hereditary elliptocytosis, PNH, G6PD deficiency, aplastic anemia which might be the cause of anemia in 76 (47 females + 29 males) patients.

Microcytic hypochromic anemia was seen in 17 out of 100 anemic patients. Its common causes are iron deficiency, sideroblastic, chronic disease, inflammation, lead poisoning and thalassemia trait.

Normochromic normocytic anemia was recorded in 56 patients among them 37 subjects were females while 19 subjects were males. Further, macrocytic normochromic anemia was seen in 9 patients with larger than normal size of red blood cells but normal color seen in cases of megaloblastic anemia (B12 or folate deficiency), alcoholism, liver disease, reticulocytosis, chemotherapy, myelodysplastic syndromes, multiple myeloma, and hypothyroidism.

Hyperchromic anemia was observed in 9 patients (5 females and 4 males). This type of morphology was commonly seen in patients having high MCHC. There was no specific term as hyperchromic anemia. In spherocytosis, the MCHC is increased due to loss of membrane and the consequent spherical shape assumed by the cell.

Discussion

Prevalence of anemia is high in India and is widely seen in all age groups; the major cause of which is iron deficiency anemia.[15] In our study, of the 100 anemic cases, females were 62% and males were 38%.

Recent estimates of iron-deficiency anaemia show that 52% of Indian women aged 15-49 years are anemic.[18] Similarly, in present study maximum females showed microcytic anemia which has its most common cause to be iron

deficiency. The population group with the greatest number of individuals affected is pregnant women (41.8%). 16 In women, anaemia may become the underlying cause of maternal mortality and perinatal mortality. 17 Nearly 50 per cent of women of reproductive age and 26 per cent of men in the age group of 15-59 years are anemic.[14]

Most of the anemias are due to inadequate supply of nutrients like iron, folic acid and vitamin B12, proteins, amino acids, vitamins A, C, and other vitamins of B-complex group i.e., niacin and pantothenic acid are also involved in the maintenance of hemoglobin level.[8]

Studies documented that IDA is more common in adult female. 18 Blood loss is the most common cause of IDA in adults, and the loss is usually from the genital tract in women. 19 also it was reported that women are significantly more exposed to IDA than men and IDA has been observed in girls ten times more than boys.[20]

Our study is in accord with a number of studies which suggest that increase in RDW is sensitive for iron deficiency. However, frequent occurrence of increased RDW in thalassemia and other conditions limits it specificity in the diagnosis of microcytic anemias. Further diagnostic investigations like bone marrow iron, serum ferritin, serum iron, serum total iron binding capacity, serum transferrin saturation and Hb studies are still necessary to make an appropriate diagnosis of the cause of microcytosis with precision.[21,22] But all these tests are either invasive or relatively expensive, time consuming and specialized techniques requiring sophisticated laboratories and therefore, cannot be done routinely. Hence RDW, which all recent automated cell counters display can be used as a cheap, time efficient and reliable early indicator to distinguish between iron deficiency anemia and other causes of microcytosis.

Conclusion

Present study underlined the importance and role of RDW in diagnosis of iron deficiency anemia. In a scenario of high prevalence of anemia in our country and even higher costs of specialized tests, the need to adopt cost effective, accurate and efficient measures is required.

Moreover, there is an urgent need for improving overall nutritional status of adolescents through nutrition education, community awareness and supplementation programs. The need for regular blood tests to check hemoglobin levels is emphasized. Emphasis is needed for corrective measures of anemia and iron deficiency in girls before they enter into adolescent age group. Since different etiologic factors result in characteristically different red cell morphology, the clinician can properly plan the management of a patient with an anemia if the blood counts are interpreted according to red cell indices.

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