

Study of Morphological Patterns of Anemia in Adults

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Abstract:

Background: Anemia is one of the common findings in patients irrespective of the presenting complaints and disease. Anemia is not a diagnosis itself, but it is a sign of underlying disease. Hence the evaluation of a patient with anemia is directed at elucidating the causes for the patient's reduced number and morphological changes of red blood cells. Since the diagnosis and treatment of anemic patients is based on the morphological patterns of anemia, hence this study was undertaken to study the morphological patterns of anemia in adult population.

Material and methods: This cross-sectional study was conducted in the Department of Pathology, Government Medical College, Jammu over a period of one year on 100 anemic patients. The EDTA anticoagulated venous samples received from the patients were run on automated hematology analyzer. Smears were made from the venous blood samples collected in EDTA vacutainer tubes and stained using Leishman's stain following standard protocol. The smears were screened to observe the morphology of the red blood cells.

Results: Majority of the patients belonged to the age group of 21-40 years with mean age of 41.3 years. Pallor was the most common clinical presentation seen in 45% of the patients. Majority of the patients (45%) had mild degree of anemia with haemoglobin levels more than 9gm/dl. Normocytic normochromic anemia was the most common pattern of anemia seen in 40% patients. This was followed by microcytic hypochromic anemia seen in 29% cases. Macrocytic Anemia was seen in 10 % cases. Dimorphic anemia was seen in 14 % cases.

Conclusion: It is necessary to evaluate anemia for early diagnosis and treatment of the patients. For the evaluation of anemia, morphological patterns provide a clue to the underlying pathology. Therefore treating anemia in early stages reduces the morbidity and mortality rate and improves the quality of life.

Keywords: Anemia, Normocytic Normochromic, Microcytic hypochromic, Macrocytic, Dimorphic Anemia

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I. Introduction

Anemia is a global public health problem affecting both developing and developed countries with major consequences for human health as well as social and economic development.¹ Anemia is one of the common findings in patients irrespective of the presenting complaints and disease. Globally, anemia affects 1.62 billion people, which corresponds to 24.8% of the population. India is one of the countries with very high prevalence rates. NFHS-3 (National Family Health Survey) reveals the prevalence of anemia to be 70-80% in children, 70% in pregnant women and 24% in adult men.²

Symptomatology of anemia which may be specific or non-specific, depends on factors such as age of the individual, cardio-vascular reserve, the chronicity of the anemia, co-morbidities and others. Non-specific features of anemia are hypoxia related effects on organ systems especially heart, brain and muscles. They include easy fatigability, dizziness, fainting spells, malaise, palpitations and dizziness.³

World Health Organisation (WHO) defines the lower limit of normal for hemoglobin concentration at sea level to be 12.0 g/dl in women and 13.0 g/dl in men. Normal hemoglobin distributions vary with age, sex, and physiological status, e.g., during pregnancy.

Anemia is not a diagnosis itself, but it is a sign of underlying disease. Hence the evaluation of a patient with anemia is directed at elucidating the causes for the patient's reduced number and morphological changes of red blood cells. An initial morphological classification of anemia with integration of red blood cell indices and morphological characteristics is probably most useful. The classification of anemia is also very important for the appropriate treatment of the underlying disease. Hence anemia is categorised by RBC size as microcytic, normocytic, or macrocytic. Microcytic anemia associated with iron deficiency is the most prevalent micronutrient deficiency disease in the world affecting 2 billion people.⁴

Anemia is diagnosed either by manual method i.e. peripheral blood smear examination or by automated hematology analyzer. The microscopic examination of a peripheral blood smear provides a wealth of information to the clinician. Various forms of anemia may actually be diagnosed from abnormal red cell morphology reported on a blood smear examination. The red cell morphology evaluation should include

examination for deviation in size, shape, distribution, concentration of haemoglobin, colour and the appearance of inclusions.⁵

Since the diagnosis and treatment of anemic patients is based on the morphological patterns of anemia, hence this study was undertaken to study the morphological patterns of anemia in adult population.

II. Material and Methods

This cross-sectional study was conducted in the Department of Pathology, Government Medical College, Jammu over a period of one year from November 2017 to October 2018 on 100 anemic who were referred to the Hematology wing of the Department of Pathology by various clinical departments for routine Complete Blood Cell Counts. All anemic patients with haemoglobin concentration less than 12 g/dl in women and less than 13 g/dl in men were included in the study. EDTA anticoagulated samples of the patients were received in the laboratory for morphological evaluation of anemia.

A detailed clinical history was taken from the anemic patients and complete data of each patient was prepared. The EDTA anticoagulated venous samples received from the patients were run on automated hematology analyzer. The smears were made simultaneously from the venous blood samples collected in EDTA vacutainer tubes and stained using Leishman's stain following standard protocol. The smears were screened to observe the morphology of the red blood cells.

The hematological investigations comprised of the following tests:

- A. Complete Blood Count (CBC) on automated hematology analyzer. The analyzer used in the study was HORIBA Pentra DX Nexus which is a seven part hematology analyzer.
- B. Peripheral blood smear examination

Detailed PBF examination included –

1.) RBC morphology which included

- a) The shape and size of RBCs (Normocytes, Microcytes, Macrocytes or dimorphic population) along with the deviation in shape and size (anisocytosis, poikilocytosis or anisopoikilocytosis).
- b) The distribution and concentration of haemoglobin in red blood cells ie chromia (normochromic, hypochromic, hyperchromic, polychromasia).
- c) Any presence of pencil cells or cigar shaped cells.
- d) Pessary cells
- e) Macro-ovalocytes
- f) Target cells, spherocytes, sickle cells, acanthocytes, echinocytes, schistocytes, blister cells etc.
- g) RBC inclusions like Heinz bodies, basophilic stipplings, cabots ring, howell jolly bodies etc.
- h) Nucleated RBCs per 100 WBCs.

The morphological evaluation of anemia was done on the basis of RBC indices obtained from automated hematology analyzer and on peripheral blood smear examination.

III. Results

The age distribution of the anemic patients varied over a wide range from 21 to 86 years. However majority of the patients belonged to the age group of 21-40 years and the mean age was 41.3 years (Table 1).

Table 1 Age distribution of 100 patients of anemia

Age in years	No. of patients	%age
21-30	31	31.0
31-40	27	27.0
41-50	12	12.0
51-60	13	13.0
61-70	14	14.0
71-80	2	2.0
>80	1	1.0

Females constituted 55% of the total patients with female to male ratio of 1.22:1 (Table 2).

Table 2 Sex distribution of 100 patients of anemia

Sex	No. of patients	% age
Female	55	55.0
Male	45	45.0
Total	100	100

Pallor was the most common clinical presentation seen in 45% of the patients. Generalised weakness was seen in 18% and dyspnea in 9% cases. Fever was seen in 26% cases (Table 3)

Table 3 Clinical history in 100 patients of anemia

Clinical history	No. of patients	%age
Fever	26	26.0
Generalised weakness	18	18.0
Dyspnea	9	9.0
Pallor	45	45.0
Jaundice	2	2.0
Bleeding	6	6.0
Pedal edema	3	3.0
Trauma	11	11.0
Pain abdomen	29	29.0
Splenomegaly	1	1.0
Burns	4	4.0
Loss of consciousness	2	2.0

As shown in Table no. 4, majority of the patients (45%) had mild degree of anemia with haemoglobin levels more than 9gm/dl. 39 patients had moderate anemia with haemoglobin levels in the range of 6 to 9 gm/dl. Severe anemia with haemoglobin less than 6gm/dl was seen in 16 patients. Mean Hb in 100 patients of anemia was 8.1g/dl. Lowest haemoglobin value was 3.1 gm/dl seen in a patient of nutritional deficiency anemia.

Table 4 The haemoglobin levels in patients of anemia.

S.No	Haemoglobin in gm/dl	No. of patients	%age
1	Less than 6	16	16.0
2	6-9	39	39.0
3	More than 9	45	45.0
4	Total	100	100

In our study the mean value of MCV in 100 patients of anemia was 82.72 (14.06). The MCH in 100 patients had a mean value of 28.54(5.13). The highest MCV (122 fl) and MCH (44.5 pg) was seen in a 68 year old male with congestive cardiac failure. The mean value of MCHC was 33.33(2.82). The RDW ranged from 11.6% to 33% with the mean value of 17.15 ± 5.13 (Table5).

Table 5 showing mean value of RBC indices in 100 patients of anemia.

RBC indices	Minimum MCV	Maximum MCV	Mean(SD)
MCV (fl)	52.0	122.0	82.72(14.06)
MCH (pg)	14.8	44.5	28.54(5.13)
MCHC (g/dl)	18.5	36.0	33.33(2.82)
RDW (%)	11.6	33.0	17.15(5.13)

Majority of the patients (40%) showed normocytic normochromic anemia. This was followed by microcytic hypochromic anemia seen in 29% cases. Macrocytic Anemia was seen in 10 % cases. Dimorphic anemia was seen in 14 % cases (Table 6).

Table 6 showing distribution of patients as per the morphological type of anemia on PBF.

Type of anemia	No. of patients	%age
Normocytic Normochromic	40	40.0
Normocytic Hypochromic	7	7.0
Microcytic Hypochromic	29	29.0
Macrocytic	10	10.0
Dimorphic Anemia	14	14.0

Majority of the patients with microcytic hypochromic red blood cells with raised RDW showed additional morphological features indicative of iron deficiency anemia. However, 7 patients of microcytic hypochromic anemia with normal RDW did not show these additional RBC features (Anemia of chronic disorders).

IV. Discussion

The first step in investigating anemia is to study the morphological type of anemia which provides valuable information and aids the clinician/haematologist to further investigate the patient in order to identify the cause of anemia so that it can be appropriately treated. In our study, the result of data analysis obtained showed a predominance of females amongst 100 patients. Females constituted 55% of the total patients with female to male ratio of 1.22:1. Similar sex distribution result was obtained in the study of Jadhav MV et al⁶

with female to male ratio of 1.25:1 and Singhal S et al⁷ in which 64.9% females were affected with anemia. Sandhya V & Rashmi GS reported 51.4% females and 48.6% males with anemia.⁸ The age of the patients in the present study ranged from 21 to 86 years with mean age of 41.3 years. Majority of the patients (58%) belonged to the age group of 21-40 years. This is consistent with the findings of Jadhav MV et al where majority of the patients (51.3%) were in the age group of 21-40 years.⁶ This similarity may be due to possible relationship of this age group with increased nutritional needs and parity. This is also comparable with the findings of Swaroop Raj BV et al in which majority of the cases of anemia in women of reproductive age group belonged to 15-30 years that is 53.7%.² Mishra P et al in his study of anemia in women of reproductive age group found that majority of his cases belonged to the age group of 15-30 years that is 63.9%.⁹ Mukaya JE et al had majority of the cases of anemia being seen in women less than 40 years of age forming 58% of the total cases.¹⁰

In our study, pallor was the most common clinical presentation seen in 45% of the patients. Generalised weakness was seen in 18% and dyspnea in 9% cases. Similar results were obtained in a study conducted by Chandurkar M & Pendalya S in which the most common sign and symptom in anemic patients was pallor which was seen in 94% cases and easy fatigability which was present in 80 % patients.¹¹ In our study, majority of the patients (45%) had mild degree of anemia with haemoglobin levels more than 9 gm/dl. 39 patients had moderate anemia with haemoglobin levels in the range of 6 to 9 gm/dl. Severe anemia with haemoglobin less than 6gm/dl was seen in 16 patients. Mean Hb in 100 patients of anemia was 8.1 g/dl. This is consistent with the findings of Sultan AH where majority (88.4%) of the anemic patients had mild anemia, 7.2% were moderately anemic and 2.3% were severely anemic.¹² This is also comparable with the findings of Singla S et al in which the mean haemoglobin was 9.24 gm% with majority of the cases having haemoglobin in the range of 7-10 gm/dl.¹³ Studies conducted by Kumar A et al⁴; Sandhya V & Rashmi GS⁸ and Patel S et al¹⁵ showed mean hemoglobin as 7.2 gm%, 7.7gm% and 5.85 gm% respectively. In our study, the mean value of MCV (fl), MCH (pg) and MCHC (g/dl) in 100 patients of anemia was 82.72 fl, 28.54 pg and 33.33 g/dl. Sandhya V & Rashmi GS also reported mean MCV, MCH and MCHC of 81.09 fl, 25.2 pg and 31.11 g/dl respectively.⁸

On PBF majority of the patients (40%) showed normocytic normochromic anemia followed by microcytic hypochromic anemia seen in 29% cases. This finding was similar to the study by Kaur H et al⁶ in which normocytic normochromic anemia was the predominant type seen in 56% cases. Microcytic hypochromic anemia 46.50% was the predominant type of anemia seen in study by Patel S et al.¹⁵ Mukaya JE et al in his study of 165 cases of anemia had Microcytic Hypochromic anemia (54%) as the most common morphological type of anemia followed by Normocytic normochromic anemia (31%).¹⁰ Bain BJ in her review on the place of peripheral blood smear examination in the age of automation in 2005 stated that even in the age of molecular analysis, the blood smear remains an important diagnostic tool and sophisticated modern investigations of hematologic disorders should be interpreted in the light of peripheral blood features as well as the clinical context.¹⁷

V. Conclusion

Anemia is a very common health problem. Hence it is necessary to evaluate anemia for early diagnosis and treatment of the patients. For the evaluation of anemia, morphological patterns provide a clue to the underlying pathology. The study of the basic blood parameters along with the peripheral smear examination is mandatory in the work up of anemia. Therefore treating anemia in early stages reduces the morbidity and mortality rate and improves the quality of life.

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