

**Study of Anemia Pattern and its Correlation with Hematological Parameters in a Tertiary Care Centre**Priyali<sup>1</sup>, Anita Sharan<sup>2</sup>, Pradeep Mahindrakar<sup>3</sup><sup>1</sup>Assistant Professor, Department of Pathology, D Y Patil Medical College, Navi Mumbai<sup>2,3</sup>Associate Professor, Department of Pathology, D Y Patil Medical College, Navi Mumbai

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Conflict of interest: Nil

**Abstract:****Background:** Low levels of hemoglobin (Hb) and insufficient capacity to carry enough oxygen for the body's physiological requirements are characteristics of anemia. The aim of the present study was to examine the hematological markers of anemia in a tertiary care setting.**Methods:** The current investigation was a cross-sectional observational study that involved patients with hemoglobin levels less than 11 g/dl who were between the ages of 18 and 60 and might be male or female. Samples were processed at the central clinical laboratory at our hospital. All samples were run via a hematological analyzer and a peripheral blood smear examination.**Results:** 926 of the 2366 samples evaluated for the current investigation were eligible for analysis. The majority (55.51%) of people were women, aged 51 to 60 (35.85%). According to anemia severity, the majority had mild anemia (9.1–11 gm%), which was followed by moderate anemia (7.1–9 gm%) and severe anemia (7 gm%) (12.31%). Based on the results of the peripheral smear test, anemia was typed. Less frequent forms included macrocytic (9.61%), dimorphic (5.94%), hemolytic (3.13%), and pancytopenia (0.54%), whereas microcytic hypochromic (53.24%) and normocytic normochromic (27.54%) were the most prevalent. On the basis of the histogram and red cell indices, anemia was typed. Less frequent forms included macrocytic (9.83%), dimorphic (7.24%), hemolytic (2.38%), and pancytopenia (0.43%). The most prevalent types were microcytic hypochromic (57.24%) and normocytic normochromic (22.89%). Red cell indices and peripheral smear results were examined to determine the anemia pattern; neither group showed statistically significant differences.**Conclusion:** Red cell indices should be used as a screening technique to identify problematic samples, then a peripheral smear test should be performed for a definitive diagnosis.**Keywords:** anemia pattern, peripheral smear findings, red cell indices, hematology analyser.This is an Open Access article that uses a funding model which does not charge readers or their institutions for access and distributed under the terms of the Creative Commons Attribution License (<http://creativecommons.org/licenses/by/4.0>) and the Budapest Open Access Initiative (<http://www.budapestopenaccessinitiative.org/read>), which permit unrestricted use, distribution, and reproduction in any medium, provided original work is properly credited.**Introduction**

Low hemoglobin (Hb) concentration and insufficient oxygen-carrying ability to meet physiological demands of the body are the hallmarks of anemia. When the blood's hemoglobin concentration falls below an age- and sex-specific threshold or cut off, anemia is typically diagnosed. [1,2] Iron deficiency anemia is the most widespread nutritional condition in the world, predominately affecting young children (6-24 months), teenagers, women in their reproductive years, and pregnant and breastfeeding women. [3,4]

Three categories of anemia exist: etiology, red cell morphology, and clinical manifestation. Red cell indices such as mean corpuscular volume, mean corpuscular hemoglobin, mean corpuscular hemoglobin concentration, and red cell distribution width are used to classify anemia based on the study of total RBC count, hemoglobin, packed cell volume, and red cell indices. [5,6] Analyzing the

morphology of the RBCs during a peripheral blood smear (PBS) examination is an inexpensive and quick way to classify various types of anemias. A complete blood count (CBC) and peripheral blood smear examination by automated hematology analysers can provide a more reliable report on classifying various anemia kinds. [7] The purpose of the current investigation was to analyze the hematological parameters of anemia in a tertiary care setting.

**Materials and Methods**

This study was conducted at D Y Patil Medical College, Navi Mumbai from March 2016 to August 2016 for duration of six months. Inpatients of all age groups were included in this study.

Blood was obtained using EDTA vacutainer tubes, and in the lab, haematological parameters were examined using a Mindray and Horiba 5 part

hematology analyzer. Red blood cell indices including packed cell volume, mean corpuscular volume, mean corpuscular hemoglobin, mean corpuscular haemoglobin concentration, and red cell distribution width were assessed together with total red cell count, hemoglobin concentration, and red blood cell count. Anemia is morphologically classified based on mean corpuscular volume, and this categorization is verified by peripheral smear testing. Analyses were conducted statistically using the Chi square test.

### Results:

926 of the 2366 samples evaluated for the current investigation were eligible for analysis. The majority (55.51%) of people were women, aged 51 to 60 (35.85%).

According to anemia severity, the majority had mild anemia (9.1–11 gm%), which was followed by moderate anemia (7.1–9 gm%) and severe anemia (7 gm%) (12.31%).

**Table 1: General characteristics**

Characteristics	Mild (9.1-11 gm %)	Moderate (7.1-9 gm %)	Severe (<7 gm %)	Total
<b>Age group (years)</b>				
18-30	69 (7.45 %)	36 (3.89 %)	11 (1.19 %)	116 (12.53 %)
31-40	134 (14.47 %)	54 (5.83 %)	23 (2.48 %)	211 (22.79 %)
41-50	173 (18.68 %)	68 (7.34 %)	26 (2.81 %)	267 (28.83 %)
51-60	191 (20.63 %)	87 (9.4 %)	54 (5.83 %)	332 (35.85 %)
<b>Gender</b>				
Male	265 (28.62 %)	99 (10.69 %)	48 (5.18 %)	412 (44.49 %)
Female	302 (32.61 %)	146 (15.77 %)	66 (7.13 %)	514 (55.51 %)
Total	567 (61.23 %)	245 (26.46 %)	114 (12.31 %)	926

Based on the results of the peripheral smear test, anemia was typed. Less frequent forms included macrocytic (9.61%), dimorphic (5.94%), hemolytic (3.13%), and pancytopenia (0.54%), whereas the most prevalent types were microcytic hypochromic (53.24%) and normocytic normochromic (27.54%).

**Table 2: Distribution of anemia cases based on peripheral smear**

Type of anemia	Cases	Percentage
Microcytic hypochromic	493	53.24%
Normocytic normochromic	255	27.54%
Macrocytic	89	9.61%
Dimorphic	55	5.94%
Homolytic	29	3.13%
Pancytopenia	5	0.54%

On the basis of the histogram and red cell indices, anemia was typed. Microcytic hypochromic (57.24%) and normocytic normochromic (22.89%) were the two most prevalent forms, whereas macrocytic (9.83%), dimorphic (7.24%), hemolytic (2.38%), and pancytopenia (0.43%) were less frequent.

**Table 3: Distribution of anemia cases on red cell indices and histogram**

Type of anemia	Cases	Percentage
Microcytic hypochromic	530	57.24%
Normocytic normochromic	212	22.89%
Macrocytic	91	9.83%
Dimorphic	67	7.24%
haemolytic	22	2.38%
Pancytopenia	4	0.43%

Red cell indices and peripheral smear anemia patterns were evaluated, and no statistically significant difference was found between the two.

**Table 4: Comparison of peripheral smear findings with red cell indices**

Type of anemia	On peripheral smear	On red cell indices and histogram	p value
Microcytic hypochromic	493 (53.24 %)	530 (57.24 %)	0.063
Normocytic normochromic	255 (27.54 %)	212 (22.89 %)	0.078
Macrocytic	89 (9.61 %)	91 (9.83 %)	0.083
Dimorphic	55 (5.94 %)	67 (7.24 %)	0.066
haemolytic	29 (3.13 %)	22 (2.38 %)	0.075
Pancytopenia	5 (0.54 %)	4 (0.43 %)	0.057

### Discussion

Priyali *et al.*

International Journal of Pharmaceutical and Clinical Research

The most frequent nutritional anemias are megaloblastic anemia, caused by folic acid or vitamin B12 deficiency, and microcytic, hypochromic anemia, caused by iron shortage. Nutritional anemias can occur from a variety of vitamin and mineral deficits as well as some deficiencies in macronutrients. [8]

In reality, classification based on fundamental aspects of red cell morphology, such as mean corpuscular volume (MCV), enables a more rapid course of treatment. Mean corpuscular hemoglobin (MCH) measures the average hemoglobin per erythrocyte stated in pictograms (pg), whereas mean corpuscular volume (MCV) measures the average size and volume of a red blood cell expressed in femtoliters (fl). [9]

Smear tests can estimate total WBC and platelet counts as well as detect aberrant, atypical WBCs and any abnormality in platelets.

In a study by Fatima SH et al. [10], the prevalence of anemia was found to be 26.2% (872/3326), with females having a higher prevalence (44.04%) than males (5.72%) ( $p < 0.0001$ ). In the reproductive age group, the prevalence was higher (58.6%). Mild anemia (36.6%) was more common than moderate anemia (58.6%). With an incidence of 53.6%, microcytic hypochromic blood images predominate, followed by normocytic blood images at 42.2%.

Studying 4350 samples, Revathi S.R et al. [11] found that 45.5% of the patients had anemia. The predominant kind, microcytic hypochromic blood image, which accounts for 48% of cases, is followed by normocytic anemia, dimorphic smear, and macrocytic anemia. When compared to women, males were more frequently afflicted. As people age, anemia becomes more common. Iron deficiency is the main cause of anemia, which is also linked to other illnesses such nutritional deficiencies, blood loss, infections, and chronic diseases.

The prevalence of anemia was 71.58% overall in the study by Reena K et al. [12] The most frequent type of anemia was mild, then moderate. In men, 39.92%, and in women, 60.08%, anemia was prevalent. The most prevalent type of anemia in adults is microcytic hypochromic anemia, which is more prevalent in the reproductive age group and indicates iron deficiency as the primary cause. Both in men and in women, it was followed by normocytic normochromic anemia. Microcytic hypochromic anemia was the most prevalent kind in the study by Koteswari M et al. [13], and females were affected more frequently than males. The majority of patients (46.8%) had mild anemia, with hemoglobin values ranging from 6 to 9 g/dl in 691 patients. In 631 individuals, mild anemia (42.7% with hemoglobin  $> 9$  gm/dl) was seen. 155

patients had hemoglobin levels  $< 6$  and experienced severe anemia (10.5%).

The prevalence of anemia was 43.48% overall in the study by Nasrin A et al. [14] The most prevalent type of anemia was mild, which was present in 46.34% of the population, followed by moderate, which was present in 43.44%, and severe, which was present in 10.22% of the population. 49.74% of women and 50.25% of men both had anemia. In all age categories, microcytic hypochromic anemia is the most prevalent kind (occurrence rate: 46.50%). The most prevalent kind of anemia in adult patients was normocytic normochromic anemia without anisocytosis (42.25%). Men are more likely than women to have mild anemia (52.21%), but women were more likely to have moderate or severe anemia (50.98% and 51.67%, respectively).

When megaloblastic anemia is treated, when iron deficiency anemia responds to iron therapy, when normal blood is transfused to a patient with hypochromic anemia, when sideroblastic anemia is present, when macrocytic anemia develops after transfusion, when delayed transfusion reactions occur, and when a patient has a dual iron and vitamin B12 or folic acid deficiency. [15] Chronic disease-related anemia is typically accompanied by elevated ferritin levels, serum transferrin, transferrin receptor (TfR), TIBC, erythrocyte sedimentation rate, and C-reactive protein concentrations as well as decreased blood iron levels and transferrin saturation. [16]

In contemporary clinical settings, the automated hematology analyzer has taken the role of conventional manual methods for hematological parameters as the initial screening and detection approach for hematological disorders. The blood smear is still a crucial diagnostic tool in the era of molecular analysis, and sophisticated contemporary examinations of hematologic illnesses should be evaluated in light of peripheral-blood findings in addition to the clinical setting. [17]

Using the regression models we obtained for the various parameters, we could objectively examine the peripheral blood smears, which may be helpful in not only lowering interobserver variation and in making the diagnosis, but may also act as a quality control for automated counters.

## Conclusion

Red cell indices should be employed as a screening approach to pick up problematic samples, followed by a peripheral smear test for confirmed diagnosis. Anemia patterns on peripheral smear results and red cell indices findings were equivalent. The primary diagnostic tool for determining the cause of anemia has been the peripheral blood smear.

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