

## Hospital Based Study Determining Association of Peripheral Smear with RBC Indices and RBC Histogram in Diagnosis of Anemia

Drishti<sup>1</sup>, Afsara Khatoon<sup>2</sup>

<sup>1</sup>Senior Resident, Department of Pathology, Government Medical College and Hospital, Purnea, Bihar, India

<sup>2</sup>Senior Resident, Department of Pathology, Government Medical College and Hospital, Purnea, Bihar, India

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Corresponding Author: Dr. Afsara Khatoon

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### Abstract

**Aim:** The aim of the present study was to assess the correlation of peripheral smear with RBC indices and RBC histogram in diagnosis of anemia.

**Methods:** The present study was conducted in the Department of Pathology, Government medical College and Hospital, Purnea, Bihar, India. The Red blood cell histograms of all anemic patients visiting the haematology section were analyzed and tried to find a correlation between histogram and peripheral smear findings. In our study of histograms of various types of anemia total 200 cases were studied.

**Results:** The study had 140 (70%) females and 60 (30%) males. Maximum number of anemia cases was noted in 30-40 years of age range. In our study 40 (20%) cases were normocytic normochromic anemia, 130 (65%) cases were of microcytic hypochromic anemia, 6 (3%) cases were of macrocytic anemia and 20 (10%) cases were of dimorphic anemia. Pancytopenia was seen in 4 (2%) cases. In our study of 200 cases, 32 (16%) cases showed normal curve, left shift were seen in 60 (30%) cases, right shift in 10 (5%) cases, broad base in 76 (38) cases, short peak in 8 (4%) cases and bimodal curve in 14 (7%) cases.

**Conclusion:** Histogram plays an additional role with peripheral smear for diagnosing RBCs disorders. Haematology analyzers were very useful and reliable for evaluation of abnormal peripheral smears. Histogram was correlated with almost all peripheral smear interpretation in anemia cases (p value <0.001, chi square value 70.14). Majority of the cases show good correlation between PS findings and histogram but histogram could be used only as a screening tool and not a diagnostic one.

**Keywords:** Histogram, RBC, Anemia, Peripheral Smear

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### Introduction

Anemia continues to be a major public health problem worldwide, particularly among females of reproductive age in developing countries. Currently World Health Organization's global estimates of anemia prevalence averaged 29.9%. [1] Anemia constitutes an important diagnostic and clinical category of haematological disorders prevalent all over the world. RBC histogram is an integral part of automated analysis which in association with RBC indices, hematocrit and RBC distribution width provides major clues in the diagnosis and management of red cell disorders. It provides valuable information not apparent in the numerical data as in megaloblastic anaemia with developing iron deficiency. The small population of microcytic hypochromic cells is identified in the histogram as a double peak while MCV being an average value does not reflect the heterogeneity of the RBC population. [2] On the other hand, a double peak

histogram curve only indicates the presence of dual cell population which needs to be further correlated with peripheral smear findings. There have been few studies on the utility and comparison of peripheral smear findings with RBC histograms and RBC indices.

Classification of anemia is based on parameters like haemoglobin, hematocrit, MCV (Mean cell volume), RDW (Red cell distribution width), MCH (Mean corpuscular volume) and MCHC (Mean corpuscular haemoglobin concentration). These values are obtained by automated haematology analyzer and displayed as visual image in the form of RBC histogram. RBC histograms are graphical representation of cell frequencies versus cell size. RBC histogram show different pattern in various type of anemia which give clue in diagnosis of anemia. RBC histogram is an integral part of

automated haematology analysis which has increased the accuracy and improved the precision. Red cell indices and RBC histogram cannot identify condition such as red cell inclusions and membrane abnormalities. [3] Red cell indices like MCV which is a mean value does not reflect the heterogeneity of RBC population which can be identified by peripheral smear examination. So, for proper diagnosis of anemia RBC histogram, red cell indices along with peripheral smear examination are essential.

The aim of the present study was to assess the correlation of peripheral smear with RBC indices and RBC histogram in diagnosis of anemia.

### Materials and Methods

The present study was conducted in the Department of Pathology, Government medical College and Hospital, Purnea, Bihar, India for eight months. The Red blood cell histograms of all anemic patients visiting the haematology section were analyzed and tried to find a correlation between histogram and peripheral smear findings. In our study of histograms of various types of anemia total 200 cases were studied.

Complete blood count were obtained by Nihon Kohden 5 part automated haematology analyser

along with histogram. Peripheral smear examination was also done.

1. In microcytosis, the RBC graph started before 34 fl and again reached to baseline before 150 fl and referred as shift to left.

2. While in macrocytosis there was right shift where the graph started after 34 fl and reached to baseline after 150 fl.

Graph started at 34 fl and ending between 225-250 fl were considered to be a broad base.

In dimorphic anemia the RBC graph showed 2 peaks due to presence of dimorphic cells.

If the RBCs population had single lineage of cells, the graph would be constraint and gave a short peak.

### Inclusion Criteria

All cases with haemoglobin below 11 gm /dl were included.

### Exclusion Criteria

Patient having leukemoid reaction, leukemia were excluded.

Data was analysed using SPSS 22 and P-value was calculated using chi-square & degree of freedom. P value of 0.05 or less was considered statistically significant.

### Results

**Table 1: Age and sex wise distribution of anemia**

Age in yrs	10- 20	21- 30	31 -40	41 -50	51- 60	Total
Total	8	46	94	36	16	200
%	4	23	47	18	8	100
Male	7	20	15	14	4	60
Female	10	32	67	20	11	140

The study had 140 (70%) females and 60 (30%) males. Maximum number of anemia cases was noted in 30-40 years of age range.

**Table 2: Cases in different anemias**

Types of anemia	No. of cases	Percentage (%)
Hypochromic Microcytic Anemia	130	65
Normochromic Normocytic	40	20
Macrocytic	6	3
Dimorphic	20	10
Pancytopenia	4	2
Total	200	100

In our study 40 (20%) cases were normocytic normochromic anemia, 130 (65%) cases were of microcytic hypochromic anemia, 6 (3%) cases were of macrocytic anemia and 20 (10%) cases were of dimorphic anemia. Pancytopenia was seen in 4 (2%) cases.

**Table 3: Types of histogram abnormality**

Types of histogram	No. of cases	Percentage
Normal Curve	32	16
Left shift	60	30
Right Shift	10	5
Broad Base	76	38
Bimodal	14	7
Short peak	8	4

In our study of 200 cases, 32 (16%) cases showed normal curve, left shift were seen in 60 (30%) cases, right shift in 10 (5%) cases, broad base in 76 (38) cases, short peak in 8 (4%) cases and bimodal curve in 14 (7%) cases.

### Discussion

Amongst various indices, MCV and RDW were important for interpretation of morphology.<sup>4,5</sup> The curve of Red cell distribution is bell shaped and peaks within 80 to 100 fl. For homogenous population of cells the curve was smaller, while for heterogenous population the curve was wider. The curve was shifted to right in megaloblastic anemia due to macrocytes ;while in microcytic anemia it was shifted to left. If the patient had received treatment, Morphologically two red cell population was seen, in which multiple peaks can be observed and is referred to as Dimporphic anemia. In these conditions RDW was the better indicator than MCV to assess anisocytosis. [6,7]

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The change in conductance results in an electrical pulse, the amplitude of which is proportional to the cell volume. [13] The y axis represents the number of cells per channel, while X axis represents its size, data is further processed by the computer, and the RBC Curve is smoothed by a moving average technique and displayed on a data management system. Sometimes WBCs are also presented in RBC channel and counted with red blood cells. If WBCs count was more than 50000 cells, RBC histogram might be affected. MCV and MCH were decreased in microcytic hypochromic anemia but

MCHC was normal. RBC with low MCV had shown shift to left. [13,14]

### Conclusion

Histogram plays an additional role with peripheral smear for diagnosing RBCs disorders. Haematology analyzers were very useful and reliable for evaluation of abnormal peripheral smears. Histogram was correlated with almost all peripheral smear interpretation in anemia cases (p value <0.001, chi square value 70.14). Majority of the cases show good correlation between PS findings and histogram but histogram could be used only as a screening tool and not a diagnostic one.

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