Journal of Neonatal Surgery
ISSN(Online): 2226-0439
Vol. 14, Issue 12s (2025)
https://www.jneonatalsurg.com

OPEN ACCESS

Observational Study of RBC Histogram in Various Type of Anemia in Adults of Age (18-55)

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Cite this paper as: Mayank Kumar, Ruby Khan, Harsh Raj, Ravi Kumar, Anamika pandey, Stuti Katiyar, Ankit Tiwari, Soni Kushwaha, Dr. Versha Prasad, Dr Nisha Sharma, (2025) Observational Study of RBC Histogram in Various Type of Anemia in Adults of Age (18-55). *Journal of Neonatal Surgery*, 14 (12s), 300-306.

ABSTRACT

Peripheral smear examination and complete blood count by automated analysers work in tandem to offer a thorough report on the patient's blood sample. Information can be communicated more effectively through visual images than through numerical data. It facilitates the immediate diagnosis of various anemias by laboratory staff using. An automated haematology analyser and peripheral smear correlation. Anemia is a prevalent

Haematological disorder characterized by a reduction in red blood cell (RBC) count or heamoglobin concentration leading to Impaired oxygen delivery to tissues. The RBC histogram is a valuable diagnostic tool visually that represents the distribution of

RBC size (Mean Corpuscular volume, or MCV) and their variations This observational study aims to explore the relationship

Between RBC histogram patterns and various type of anemia in adults aged 18-55. We analyzed the RBC histogram profiles In individuals with iron-deficiency anemia (IDA), thalassemia, the RBC deficiency, and anemia of chronic disease (ACD) to identify

Distinctive patterns that could assist in early diagnosis and classification of anemia types.

Keywords: *To study of peripheral smear RBC indices and RBC histogram in diagnosis different types of anemia (Microcytic hypochromic, Macrocytic, Normochromic normocytic.)*

1. INTRODUCTION

Anemia is a serious global public health issue that affects a large percentage of adults, especially those between the ages of 18-55

Effective care depends on an early and precise diagnosis. The RBC histogram is a graphical depiction of the distribution of red blood

Cells according to their size, and blood tests such as the complete blood count (CBC) supplied crucial information. Clinicians can use

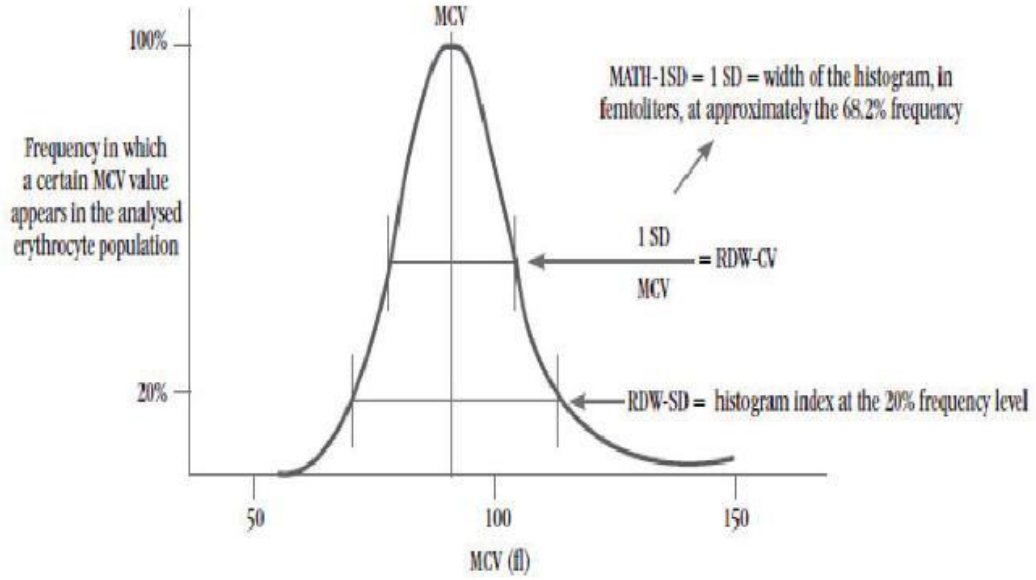
The histogram to aid in differential diagnosis and get insight into the underlying etiology of anemia. This study's main objective is to

Investigate the distinct RBC histogram patterns linked to different forms of adult anemia[1]. Histograms show cell frequencies as a function of size graphically. Cell size is represented by the X axis and cell number is represented

By the Y axis. They offer important hints. They provide major clues in the diagnosis and management of significant red cell disorder.

Normal red cell histogram are symmetric, single-peaked Guassian or bell shaped curves (figure1) The distribution should always start End on base line and should be located between the two discriminators[1] DDSs, like macroscopic drug depots, assisted in lowering systemic toxicity [5]. But, because they were dependent on outside variables like pH, temperature, and ionic strength and

FIGURE 1: NORMAL RBC HISTOGRAM.



FOLLOWING ARE THE IMPORTANT POINT TO CONSIDER WHEN OBSERVATION /ANALYZING HISTOGRAMS.

INVESTIGATION:

- Individual population positions in relation to typical, normal positions.
- Amount of population separation as opposed to usual or normal separation.
- Each population's relative concentration in relation to usual or normal separation.
- Existence of populations that are unexpected or non-typical.

A distribution is said to be skewed when it is not symmetrical. The bulk of each cell in a typical RBC histogram lies between 55fl and 125fl. Anomalous pulses[1] and coincident doublets make up the distribution's tail . The width of the histogram at 1 SD from the mean divided by

MCH is used to compute the RDW.RDW-CV Typically ranges from 11.5% to 14.5%. The typical RDW-SD has an arithmetic width of 39 to 47 fl. Increased RDW shows a mild broad base histogram [4,5,6.].

CAUSES OF DEVIATION FROM NORMAL RBC HISTOGRAM:

1. **SHIFT TO LEFT:** When the cells are smaller than usual, the curve will shift more to the left (figure2), similar to untreated iron deficiency anemia.
2. **SHIFT TO RIGHT:** If the cells are larger than typical, the histogram curve will shift more to the right (figure3), as seen in megaloblastic anemia. Once the Underlying causes of anemia are properly treated the curve should return to the normal range.
3. **RU FLAGE (FIGURE4):** The RU flag is visible when the upper discriminator surpasses the preset height by 5%. Factors contributing to RU flag include cold agglutination and the formation of Rouleaux.
4. **RU Flag (Figure 5):** The RU flag appears when the lower discriminator surpasses the predetermined height by 10%. The reasons for RU flag consist of large platelets, micro-erythrocytes, and broken RBCs.
5. **Multiple peak (MP):** The presence of more than one peak suggests the existence of two or more populations of RBCs. Causes for multiple peaks (Figure 6) involve iron deficiency anemia during recovery, post-transfusion reactions, extreme leukocytosis, and cold agglutinin disease.
6. **In leukemia:** an extended right peak is noted. In reticulocytosis, a right shoulder is visible (Figure7).

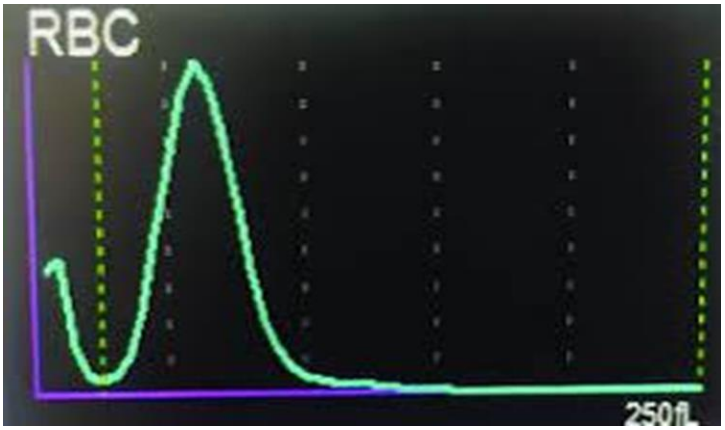


FIGURE 2: Microcytic RBCs Showing Shift to left.

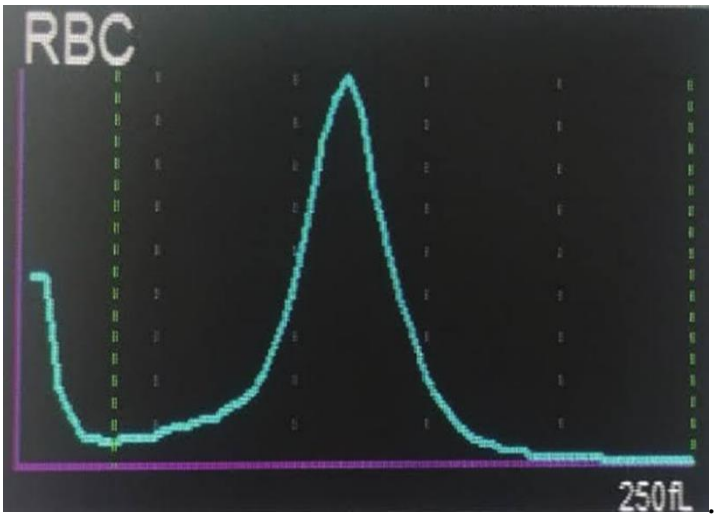
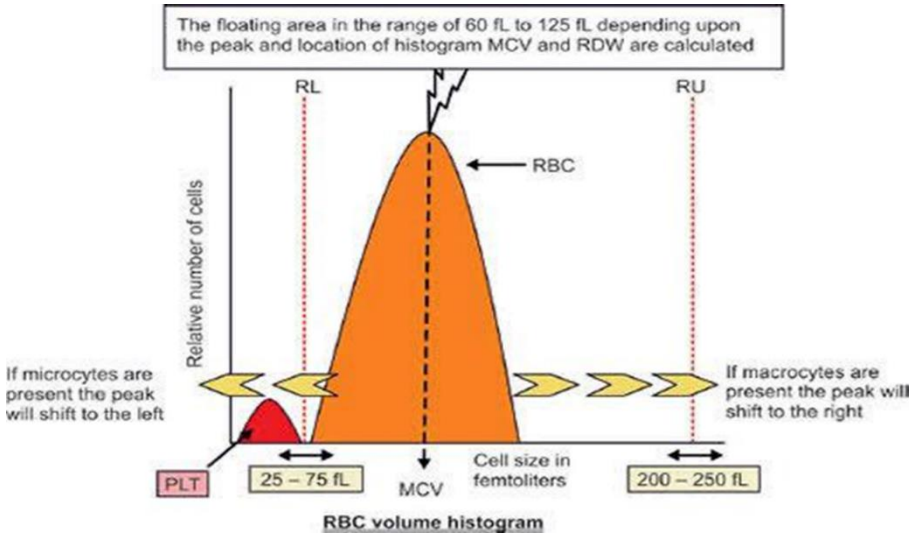


FIGURE 3: Macrocytic RBCs Showing Shift to right



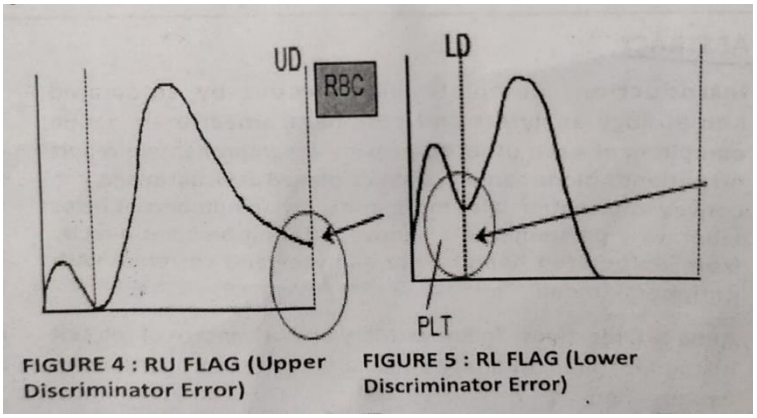


FIGURE 4 : RU FLAG (Upper Discriminator Error)

FIGURE 5 : RL FLAG (Lower Discriminator Error)

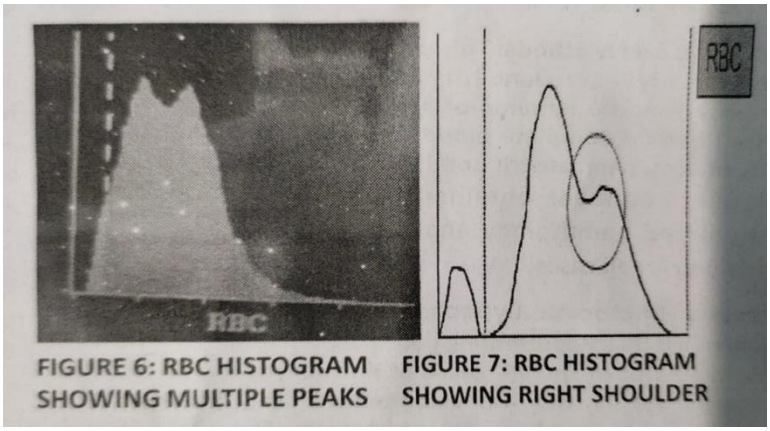


FIGURE 6: RBC HISTOGRAM SHOWING MULTIPLE PEAKS

FIGURE 7: RBC HISTOGRAM SHOWING RIGHT SHOULDER

2. MATERIAL AND METHODS

Sample Size- This observational study took place at the haematology laboratory of the School of Health Sciences, CSJMU Kanpur, and GSVM Medical College, Kanpur, spanning a duration of six months. A total of 200 adult anemic patients, aged 18-55, showing symptoms of anemia were included. The patients were grouped into four categories according to their clinical and laboratory results

1. Iron- Deficiency Anemia.
2. Thalassemia.
3. Normocytic
4. Microcytic Hypochromic
5. Dimorphic
6. Pancytopenia
7. Sickle cell anemia.

RBC histograms were generated with an automated haematology analyser that assesses metrics like mean corpuscular volume (MCV), red cell distribution width (RDW), and reticulocyte count. The RBC histograms for every patient were examined for unique patterns, such as skewness, width, and peak shape.

Data Collection Sampling Collection and Storage-

The research encompassed young adult men and women. Data regarding their age, job, and education was gathered. A 2ml specimen of peripheral venous blood was collected from each participant utilizing the correct venipuncture method and deposited in an EDTA anticoagulant tube for haematology evaluation, encompassing a complete blood count. Blood smear and reticulocyte blood test.

3. GENRAL LABORATORY EQUIPMENT

Summarizes the general laboratory equipment /instruments used in this study with the name of their of manufacture and country of origin

S.NO.	INSTRUMENT	MANUFACTURE	COUNTRY OF ORIGIN
1	REFRIGENERATOR	SAMSONG	JAPAN
2	MICROSCOPE	OLYMPUS EX31	JAPAN
3	MICROPIPETTE	ERBA	INDIA
4	GLASS SLIDE	SUPERTEK	INDIA
5	EDTA TUBE	B D VACCUTANER	INDIA
6	CBC MACHINE	ERBA	INDIA

Distribution of cases based on Heamoglobin percentage

DEGREE OF ANEMIA CASES	PERCENTAGE
MILD	21%
MODERATE	60%
SEVERE	19%

Tabal1: Shows distribution of anemia cases based on peripheral smear examination

IMPRESSION	NO. OF cases (n=200)	PARCENTAGE
Normocytic normochromic anemia	30	15%
Microcytic Hypochromic anemia	70	35%
Iron-Deficiency anemia	30	15%
Thalassemia	20	10%
Dimorphic anemia	20	10%
Pancytopenia	20	10%
Sickle cell anemia	10	5%

4. RESULTS

Normocytic normochromic

Anemia: Among the 35% of normocytic normochromic anemia cases,5% exhibited a standard histogram featuring a short peak while 15% presented a mild broad base curve histogram that corresponded well with the elevated RDW. The number of cell would vary in size. For instance the presence of certain microcytic or smaller cells along with some normal -size cells would lead to increased deviation resulting in higher RDW.

Microcytic Hypochromic

Anemia: Among the 70% of microcytic hypochromic anemia cases, 35% exhibited a normal histogram Attributed to mild anemia, 30% percentage a left shift histogram 2showed

a broad base curve histogram due to elevated.

RDW and 2% had a bimodal histogram as, the patient was undergoing treatment.

Iron-Deficiency Anemia

(IDA): The RBC Histogram of individuals with (IDA) displayed a significant shift toward smaller RBCs And a high RDW suggesting anisocytosis (variation in cell size). The histogram usually showed a significant left skew indicating Microcytosis (smaller cells) and hypochromic (paler cells).

Thalassemia: In the patient with thalassemia the RBC histogram showed a bimodal distribution featuring two peaks the initial Peak represents microcytic cells whereas the subsequent smaller peak relates to normocytic RBCs the RDW was usually lower than In (IDA) indicating a more uniform population of red cells even with microcytosis present.

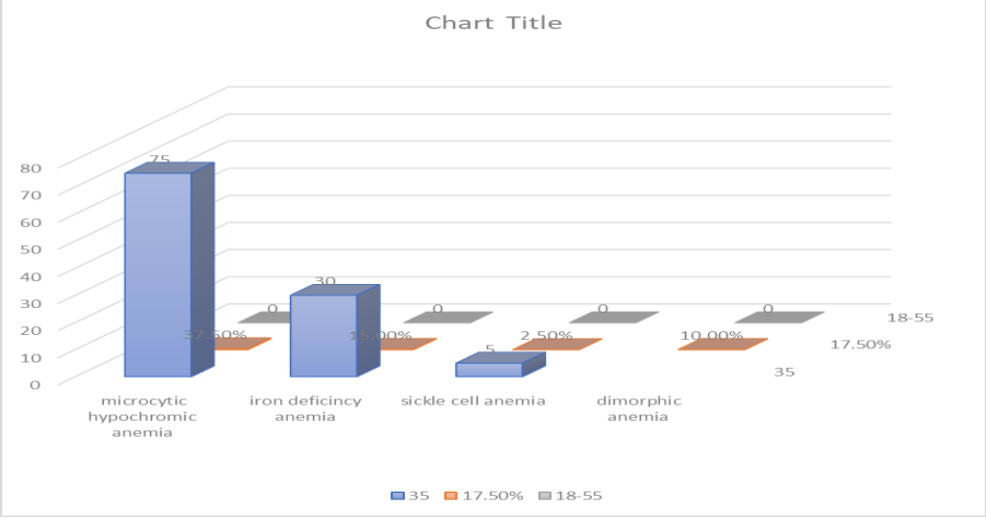
Dimorphic anemia: A dimorphic anemia presentation may show the histogram featuring two or more multiple populations Of red cells in our study dimorphic anemia displayed significant discrepancies with 1% exhibiting a normal histogram 1% showing A broad -based histogram 1% demonstrating a right histogram 1% a left histogram and 2% presenting a bimodal curve.

Pancytopenia: Among the 20% of pancytopenia cases 10% displayed a right curve resulting from severe megaloblastic anemia While the other 3% showed a short peak histogram that aligned with a reduced RBC count.

Sickle-cell anemia: In 5% of sickle cell anemia cases a broad curve with a short peak was observed, conelating strongly with Elevated RDW and reduced RBC count.

Distribution of anemia cases based on RBC indices and Histogram

Diagnosis	No. of cases (n=200)	Percentage
Normocytic normochromic anemia	30	17.5%
Microcytic Hypochromic anemia	75	37.5%
Iron-deficiency anemia	30	15.0%
Thalassemia	20	10.0%
Dimorphic anemia	20	10.0%
Pancytopenia	15	7.5%
Sickle cell anemia	5	2.5%



5. DISCUSSION

The RBC histogram may serve for screening purpose but is regarded as diagnostic for any pathological condition.An abnormal CBC report should always be compared with clinical features and blood smear findings a significant conclusion.The RBC histogram offers crucial visual indicators for diagnosing various froms of anemia.In IDA ,the left - shifted histogram along with elevated RDW assists in recognizing the existence of microcytic and hypochromic RBCs Thalassemia, conversely exhibits a distinct bimodal distributionThat sets it apart from other form of anemia.These results indicate that the RBC histogram is an effective instrument for the prompt identification and classification of anemia ,and when paired With additional laboratory tests, it can offer a thorough diagnosis method.

6. CONCLUSION

Histogram can also assist in distinguishing between different types of anemia.In most cases changes in the histogram were closely Related to the finding from the peripheral smear. Histogram analysis is frequently overlooked in the automated hemogram yet when properly interpreted it can offer valuable diagnostic insights Even prior to conducting more advanced ivestigations.The modern analyzers speed and reliability enable technologists to assess abnormal blood films analyze diagnostic hints and relate clinical findings To histograms and other hematologic metrics more confidently , ultimately resulting in significant benefits for patient health care.

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