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ORIGINAL RESEARCH

Study of peripheral blood film and RBC histogram in patients of anemia

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ABSTRACT

Introduction: Anemia is a condition in which red blood cells (RBC) count is decreased &there is reduction in their oxygen carrying ability.Peripheral blood findings and Shift of histogram curve in one direction or other can be diagnostic in the various types of anemia.**Aim:** To interpret RBC histogram and correlate peripheral blood smear with RBC histogram. **Materials and Methods:**This study was conducted at tertiarycentre hospital on 100 anemia patients.Complete hemogram,RBC indices, RBC histogram, and Peripheral smear were studied.**Results:**It was found that majority of the patients were female (58%) and belong to age group of 61-70 years with microcytic hypochromic anemia as most common blood picture accounting to 50%. Only 7% cases of dimorphic anemiawere seen. On histogram 41% cases of left shift curve, followed by normal curve (32%), broad base curve (16%), andright shift curve (8%) were observed. Only 1% case had bimodal curve.Significant association was observed between peripheral smear findings and RBC histogram with p value (<0.05).**Conclusion:**Complete hemogram with peripheral blood smear & RBC Histogram can be used as a crucial haematology screening test for the diagnosis of anaemia.

Keywords: Anemia, Histogram, Peripheral Blood Film.

INTRODUCTION

Anemia is the most common clinical condition and is defined as reduction in haemoglobin concentration. Classification of anemiaisbased on the morphological features which include the RBC size, degree of hemoglobinization and shape of red blood cells(RBCs) and RBC indices which include mean corpuscular volume (MCV), mean corpuscular haemoglobin (MCH), mean corpuscular haemoglobin concentration (MCHC).[1] Examination of the peripheral blood smear (PBS) along with these parameters is very significant.[2]

The haematology analysers work on the concept of impedance.[3] On the histogram, when the peak is falling within the usual MCV range of 80-100 fl with the normal RDW curve, it is known as Gaussian curve (bell shape). If the red cell population are diverse, a broad distribution curve is seen, whereas RBC that are homogeneous have a narrow distribution curve.[4]The base line defines where the histogram starts; however, if the histogram rises above the base line, it indicates that there is existence of microscopic particles likeplatelet clumping, malaria parasites,microspherocytes, norm oblast, elliptocytes, bacteria, and so on.[5]

Shift of histogram curve in one direction helps to identify the type of anemia.Theshift of RBC histogram curve to the right suggests megaloblastic anemia, whereas shifts of the curve to the left suggests microcytic anemia.In dimorphic anemia, due to two red cell population,the histogram shows several peaks.[6]The distribution should begin and ends on baseline and should be located between two discriminators. RU flag is seen when upper discriminator exceeds the preset height by 5%. Rouleax formation and cold agglutination are two factors that contribute to the RU flag. RL Flag is seen when lower discriminator exceeds the preset height by 10% Giant platelets, micro-erythrocytes, and fragmented RBCs are some of the causes of the RL flag.[7]

As a result,histogram along with other haematological parameters like RBC indices (Red cell distribution width, Mean Corpuscular volume, etc.) & peripheral smear has been found to be useful in identification and treatment of various red cell disorders.[8]

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The aim of the study is to interpret RBC histogram and correlate RBC histogram with Peripheral blood smear.

MATERIALS AND METHODS

This was a prospective studyconducted at Tertiary Care Centre on 100anemic patients. Complete hemogramincluding RBC indices, histogram and PBF was studied and correlation between PBF & RBC histogramwas observed.

Inclusion criteria-Anemic patients of all age group were included in study

RESULTS

The study was performed on 100 anemic patients in age group 1 to 90 years. It was observed that the majority of the patients (20%) belong to 61-70 years of age group whereas only 5% of cases were observed in age group of 1-10 years.Out of 100 cases,58% werefemalesand 42% were males. Most of the females in this study wereunder age group of 21-30 years,andmajority of males were in age group of 61-70 years. (Table I).

Out of 100 cases, 22% cases had mild anemia (Hb 10-12 gm%), followed by 48% cases ofmoderate anemia (Hb 7-10gm/dl) and 30% cases had severe anemia (Hb<7gm%).

On Peripheral smear, microcytic hypochromic anemia was most common (50%), followed by 33% cases of normocytic normochromic anemia,10% cases of macrocytic anemia& 7 % cases of dimorphic anemia.

On Histogram, left shift curve (LS) was most common (41%), followed by normal curve (32%) followed by broad base (BB) curve (16%),and 8% cases of right shift curve. Only 2 % short pick curve (SP) and 1% case of bimodal curve(BM) was seen. (Table II).

Chi square test was applied and statistically significant association was found between peripheral smear findings and RBC histogram with p value (<0.05) (Table III)

TableI: Age and gender wise distribution

		Sex		Total
		Male	Female	
Age	1-10	04	01	05
	11-20	03	04	07
	21-30	04	15	19
	31-40	06	07	13
	41-50	06	09	15
	51-60	05	10	15
	61-70	10	10	20
	70 and above	04	02	06
Total		42	58	100

Table II: Histogram Pattern

HISTOGRAM		
	Frequency	Percent
NC	32	32%
LS	41	41%
RS	08	08%
BB	16	16%
BM	01	01%
SP	02	02%
TOTAL	100	100

*NC-Normal Curve, LS-Left shift curve, RS-Right shift curve, BB-Broad base, BM-Bimodal curve, SP-Short peak curve

Table III: Correlation of Peripheral Smear findings and Histogram pattern

PS*HISTOGRAM Cross tabulation								
		HISTOGRAM						TOTAL
		NC	LS	RS	BB	BM	SP	
PS	NN	23	6	0	4	0	0	33
	MH	8	35	0	7	0	0	50
	MA	1	0	8	1	0	0	10
	DA	0	0	0	4	1	2	07
TOTAL		32	41	8	16	1	2	100

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*PS-Peripheral Smear, NN-Normocyic Normochromic, MH-Microcytic Hypochromic, MA-Macrocytic anemia, DA-Dimorphic Anemia, NC-Normal Curve, LS-Left shift curve, RS-Right shift curve, BB-Broad base, BM-Bimodal curve, SP-Short peak curve

Chi square test was applied and statistically significant association was found between peripheral smear findings and RBC histogram with p value (<0.05)

DISCUSSION

The present study was conducted on 100 anemic patients and CBC, PBF, histogram was studied. It was observed that the mean agewas 44.14 years which is in concordance with the study conducted by Japheth E Mukaya et al(2009)[9].Majority (31%) patients were found in age group of less than 30 years, which is similar to study by Korgaonker K A et al(2014)[10], according to which majority of the cases were in age group of <30 years, whereas the study by Japheth E et al(2009)[9] showed maximum number of the patients in age group of 31-40 years. Females were in majority (58.0%) as compared to males (42.0%) in this study which is similar to the study performed by Cook et al[11], and Kargaonker K A et al[10].

Majority (43%) of cases had haemoglobin 7-10gm/dl (moderate anemia) and the mean haemoglobin was found to be 7.78gm%.Microcytic hypochromic blood picture was observed to be more common (50%) and only 7% of the cases shows dimorphic anemia. These findings were compared to other studies and it was observed that the study by Japheth et al (2009)[9], and Kumar et al (2013)[2] showed the similar results. Majority of anemia cases in literature showed MCV<80fl. In a study conducted by Singla et al [12], the majority of anemia patients had MCH levels below 26pgwhereas in the study conducted by Veda S.M.K. et al (2019)[1], most of the patients showed normal MCHC.

In the current study, histogramanalysis revealed left shift curve to be the most commonand bimodal curve was least common which is in concordance with the study conducted byPatel D et al [13], andShrivastav et al[14].

CONCLUSION

A total of 100anemic patients were included in the current study. Majority of the cases had moderate anemiawith microcytic hypochromic blood picture (50 %) with female predominance. Most common histogram pattern wasleft shift curve (41%)followed by normal curve (32%) and bimodal curve was least common.

Histogram show graphical representation of cells, according to the shape, size of cells and work on principle of flow cytometry.Histogram along with other haematological parameters i.e., RBC indices (HB, RBC count, MCV, MCH, MCHC, RDW etc) and peripheral blood film examination are diagnostic test in evaluation of anemia.

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REFERENCES

1. Vedashree MK. Evaluation of haematological parameters and categorisation of anemia in adults in a tertiary care hospital. Indian J PatholOncol. 2019;6(4):593-596
2. Kumar A, Kushwaha R, Gupta C, Singh US. An analytical study on peripheral blood smears in anemia and correlation with cell counter generated red cell parameters. J ApplHematol. 2013;4(4):137-144
3. Fossat C, David M, Harle JR, Sainty D, Horschowski N, Verdot JJ, Mongin M Et al. New parameters in erythrocyte counting value of histograms.Archpathol Lab Med. 1987;111(12):1150-54.
4. Shrivastava A, Shah N, Goyal S and Shah CK. RBC histogram: Utility in diagnosis of various anemia. International Journal of Clinical and Diagnostic Pathology.2019; 2(1): 14-17
5. Kakkar N, Makkar M. Red cell cytograms generated by an ADVIA 120 automated hematologyanalyser: Characteristic patterns in common hematological conditions. Laboratory Medicine. Sep 2009;40(9):549-55.
6. Gulati GL, Hyun BH. The automated CBC: A current perspective.HematOncolClinNorth Am. 1994 Aug;8(4):593-603.
7. Shirish M Kawthalkar. Essentials of Clinical Pathology. Jaypee; Automation in hematology; First edition; 2012: Page 319-326
8. Benie T. Constantino, The Red Cell Histogram and The Dimorphic Red Cell Population.Laboratory Medicine. 2011;42 (5):300-308
9. Mukaya J E, Ddungu H,Ssali F, O'Shea T, Crowther M A.Prevalence and morphological types of anaemia and hookworm infestation in the medical emergency ward, Mulago Hospital, Uganda.S Afr Med J. 2009; 99(12):881-6.
10. Karishma A Korgaonker and Dr.Shashidhar MR. Utility of automated cell counter histograms in reporting peripheral smears in anemia. Int. J. Clin. Diagn. Pathol.2019;2(2):230-239.
11. Cook, James D., Clement A. Finch, and Nathan J. Smith.Evaluation of the iron status of a population.Blood.1976;48(3): 449-455.
12. Singla S, Bedi S, Joshi K. Comparative study of anemia cases based on peripheral blood smears and cell counter generated red cell indices.MedPulse–International Medical Journal. 2017;4(1):44-48.
13. Patel D D,Desai P N, Prajapati J A, Patel A B, Patel A D. Red blood cell histogram in different morphological types of anemia in comparison with peripheral blood smears: A comparative analysis.jcbr 2024; 8(2) :5-9.
14. Shrivastav A, Shah N, Goyal S, Shah CK. RBC histogram: Utility in diagnosis of various anemia. Int J ClinDiagn Pathol.2019 ;2(1):14-17