Importance of red blood cell histogram and indices obtained through automated hematology analyzer and comparing it with manual blood film examination

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ABSTRACT

Background: Use of automated hematology analyzer in hematology laboratory is considered as a routine as well as an essential requirement in current scenario. The burden of anemia is high worldwide and there is increasing need to diagnose and treat this condition as it may lead to many complications on long run. **Aim of the study:** The present study was carried out to measure the sensitivity of red blood cell histogram and indices obtained through automated hematology analyzer and comparing it with manual blood film examination in patients of anemia. **Material and methods:** We have done this observational cross sectional study at Central hematology laboratory of Pathology department at tertiary care center in Gujarat. One thirty patients having anemia who have consulted different departments for variable reasons were included. Demographic and laboratory data were recorded. Analysis was done by Epi info software. **Results:** The study of included total 130 patients having anemia as per the WHO criteria for diagnosis of anemia. In our study we found sensitivity of histogram to be 87.6%. For microcytic hypochormic anemia, the sensitivity and specificity of red blood cell histogram and indices were 94.2% and 63.1%. For normocytic anemia, the sensitivity and specificity of red blood cell histogram and indices were 96.7%% and 49.1%. For macrocytic anemia, the sensitivity and specificity of red blood cell histogram and indices were 98.2% and 90.3%. **Conclusion:** The study showed that red blood cell histogram and indices obtained through automated

hematology analyzers are useful in initial screening purpose and it gives overall idea about the type of anemia, but for final diagnosis and confirmation, manual blood film examination still remains the gold standard test.

KEY WORDS: Automated hematology analyzers, Histograms, Anemia

INTRODUCTION

Use of automated hematology analyzer (AHA) in hematology laboratory is considered as a routine as well as essential requirement in current scenario. These analyzers also come with very useful functions that were not possible to perform before their arrival. Many newer parameters are also becoming increasingly easier to measure with advancement of technology of AHA. But as we know, there are always some cases that need to be evaluated manually by blood film examination under microscope for confirmation and typing of different types of anemia.

We considered a patient as anemic when their hemoglobin levels were below 13g/dl in male and below 12 g/dl in a female respectively.[1] There are qualitative and quantitative methods for classification. Primary classification is based on red blood cell indices (RBCI). [2]

Manual blood film examination under microscope is a window for haematological processes that are taking place inside the body and it is also helpful to identify underlying cause of the disease. Histogram and RBCI obtained through AHA gives important insight for presence of any abnormality in the sample and further need for manual blood film examination. Different graphical representation and curves of histogram give idea about the underlying cause of anemia. [3] The present study was carried out to measure the sensitivity of red blood cell histogram and indices obtained through automated hematology analyzer and comparing it with manual blood film examination in patients of anemia.

MATERIAL AND METHODS

We have done this observational cross sectional study at Central hematology laboratoryof Pathology department at tertiary care center in Gujarat. One thirty patients having anemia who have consulted different departments for variable reasons were included. Demographic and laboratory data were recorded. Patients having anemia as per the WHO criteria of diagnosis of anemia were included in the study. Patients aged between 5 to 70 years with either gender were included the study. Patients less than 5 years and above 70 years, having history of sudden bleeding episodes, blood transfusion within last 3 months or having any kind of malignancy were excluded from the study. Two ml Blood was collected inl EDTA vaccutainer and was subjected for further hematological analysis on SYSMEX KX-21. All CBC parameters and histograms were obtained. Blood films were prepared as per the laboratory's standard operating procedure and were stained with Leishmania cytochrome stain. Morphological classification was done on basis of RBCI and manual blood film examination. We considered results to be

comparable when both methods reported the same morphological type of anemia, and non – comparable when both methods reported the different results. Epi info software was used for further statistical analysis.

RESULTS

We have done this observational cross sectional study at Central hematology laboratory of Pathology department, Dhiraj Hospital, Vadodara. One thirty patients having anemia who have consulted different departments for variable reasons were included. Demographic and laboratory data were recorded.

Out of total 130 anemic cases, males were 62(47.6%) and females were 68(52.3%). Female preponderance was seen in our study with male to female ratio of 0.9:1. (Table – 1)

Table - 1. Distribution of the cases: Gender - wise

Gender	Cases	Percentage (%)
Male	62	47.6
Female	68	52.3
Total	130	100

According to the morphological patterns based on RBC histogram and RBCI, cases fell into following 3 groups. (Table – 2) More number of cases (57.6%) was of microcytic hypochromic type, 30.7% were normocytic normochromic, and 11.5%macrocytic anemia type. Out of 75 microcytic hypochromic anemia cases, males were 30 and females were 45. Males were 18 and females were 22 from 40 normocytic normochromic anemia. Out of total 15 cases of macrocytic anemia, 14 were males and female was 1.

Table – 2. Case distribution as per RBC histogram and RBCI

Morphological type	Male	Female	Total
Microcytic hypochromic	30	45	75(57.6%)
Normocytic normochromic	18	22	40(30.7%)
Macrocytic	14	01	15(11.5%)
Total	62	68	130(100%)

The morphological patterns on manual blood film examination further divided the cases in 3 different categories. (Table – 3) Microcytic hypochromic anemia (53.8%) was the most common type, followed by normocytic normochromic (36.9%) and least common was found to be macrocytic anemia (9.2%) type. 27 males and 43 females showed microcytic hypochromic type of anemia. Normocytic normochromic anemia was seen in 23 males and 25 females.Macrocytic anemia was seen in all 12 males.

Table – 3. Case distribution as per the patterns of anemia by manual blood film examination

Type of anemia	MALE	FEMALE	TOTAL
Microcytic hypochromic	27	43	70(53.8%)
Normocytic normochromic	23	25	48(36.9%)
Macrocytic	12	00	12(9.2%)
Total	62	68	130(100%)

Table – 4 shows cases of comparable and non comparable results that were obtained via both different methods. 114 cases showed comparable results while 16 cases showed discrepancies or were non comparable.

Table – 4. Comparison of cases as per AHA findings and manual blood film examination findings

Comparable	Non comparable	Total
114	16	130

We found sensitivity of histogram to be 87.6% in our study. The sensitivity and specificity for different types of anemia is as shown in Table – 5. For microcytic hypochormic anemia, the sensitivity and specificity of red blood cell histogram and indices were 94.2% and 63.1% respectively. For normocytic anemia, the sensitivity and specificity of red blood cell histogram and indices were 96.7%% and 49.1% respectively. For macrocytic anemia, the sensitivity and specificity of red blood cell histogram and indices were 98.2% and 90.3% respectively.

Table – 5. Sensitivity and specificity of RBC histogram and indices as compared with manual blood film examination for different types of anemia

Type of anemia	Sensitivity	Specificity
Microcytic hypochromic	94.2%	63.1%
Normocytic normochromic	96.7%	49.1%
Macrocytic anemia	98.2%	90.3%

DISCUSSION

There were total 130 anemic cases in our study. We included the patients diagnosed with anemia, between the age of 5 to 70 years with both the gender. Male to female ratio was 0.9:1, which was comparable to the study done by Choudhary et al. [4] In our study, out of total 130 cases, 114 cases showed comparable results while 16 cases showed non comparable results between the AHA findings and manual blood film examination findings. These findings were similar to other previous studies as shown in Table – 6.

Table – 6. Comparison of comparable and non comparable results of different studies

Study	Total (n)	Comparable	Non comparable
Farah E et al[5]	350	274(78.3%)	76(21.7%)
Radadiya P et al[6]	100	72(72%)	28(28%)
Choudhary et al[4]	600	402(67%)	198(33%)
Present study	130	114(87.6%)	16(12.3%)

These discrepancies can be due to various reasons. E.g. RBC agglutination, fragmentation or presence of immature cells etc. All these conditions can be ruled out or ruled in by manual blood film examination. [4] Study done by Aslina et al. demonstrated that manual blood film examination is more sensitive as compared to AHA findings for diagnosis of microcytic anemia as mean corpuscular volume denotes mean distribution curve and usually ignores presence of occasional macrocytes. [7] Study done by Lantis et al. also demonstrated the similar findings to our study. [8]

Anemia can be wrongly classified if there are discordant results between AHA findings and manual blood film examination. So combination of both methods is recommended to that of AHA findings alone. [9] In addition to typing of anemia, manual blood film examination is also useful to identify other hematological disorders. It is highly advisable to carry out manual blood film examination along with AHA results for accurate diagnosis.

CONCLUSION

The study showed that red blood cell histogram and indices obtained through automated hematology analyzers are useful in initial screening purpose and it gives overall idea about the type of anemia, though it is equally important not to rely completely on analyzers. For confirmation and final diagnosis of different types of anemia, manual blood film examination still remains the gold standard test.

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