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A comparative study of cell counter generated parameters and PBS findings to diagnose and morphologically classify anemia

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Abstract
Introduction: Anemia is most prevalent health problem in our country in all age group and present in both men and women. Correct and early diagnosis of anemia is needed in each case to start proper treatment.
Objectives: This study was to find out the correlation of findings obtained automated hematology analyzer and by peripheral blood smear examination in diagnosis and morphological classification of anemia.
Methodology: This study was done at a tertiary care hospital attached with a medical college for a period of 3 month during January 2019 to March 2019. It was a prospective observational study having sample size of 400 anemic samples. In all cases blood sample were collected in EDTA vaccute and than further processed for hemoglobin estimation and findings of automated hematology analyzer and peripheral smear examination noted and compared.
Results: Out of total 400 anemic samples 153 samples were from Males and 247 samples were from females and in 88.75% of cases (355 out of 400) findings of both methods are very well correlated.
Conclusion: Both diagnostic methods have their own importance, automated hematology analyzers are useful in mass screening and bulk of work while PBS examination is needed to diagnose RBC abnormalities and correct morphological typing of anemia.

Keywords: Automated hematology analyzer, peripheral blood smear, morphological classification of anemia

Introduction
Anemia is a major public health problem that affects both developed and developing countries. More than one and half billion people are affected by this all over world and in current scenario pregnant females are the most susceptible population, which corresponds to 24.8% [1, 2]. According to WHO, hemoglobin concentration of 12.0 g/dl in women and 13.0 g/dl in men at sea level is considered as lower limit. Overall One third population of the world suffers from anemia and India is having very high prevalence rates for it. NFHS-3(National Family Health Survey) reveals that prevalence of anemia is 70% in pregnant women, 70-80% in children, and 24% in men of adult age [3].
Morphological typing of anemia helps the clinician to choose appropriate line of treatment according to the cause of anemia. RBC indices, which includes – MCV, MCH, MCHC and PCV are the base for Morphological typing of anemia. In today's era, traditional concept of preparation, staining and confirmation of analyzer's result by microscopic examination of a blood film has becoming obsolete in most institutions [4, 5, 6, 7].
The present study was done to find out the correlation of findings obtained from automated hematology analyzer with peripheral blood smear examination for morphological classification of anemia.

Objectives
1. To diagnose anemia from results of automated hematology analyzer.
2. To diagnose anemia from the findings of peripheral blood smear (PBS) examination.
3. Correlation of findings obtained from both methods.

Materials and Methods

The data obtained from central laboratory of a medical college hospital for a period of 3 month during January 2019 to March 2019. It is a prospective observational study having sample size of 400 anemic sample. A sample was considered anemic according to WHO reference range. The blood samples were collected in EDTA vaccute. Samples were run on five part hematology analyzer and peripheral blood films were made for each sample. Findings of analyzer and PBS examination are noted. In the present study, we include age range 20-70 years. Prior permission was taken from our Institutional Ethics Committee to conduct this study. Statistical analysis was done on Microsoft excel.

Inclusion criteria: 1) all anemic samples as per WHO reference range.

Exclusion Criteria: 1) Patients below 20 years were excluded. 2) Patient having any leukocyte abnormality like leukemaiod reaction, leukocytosis, leukaemia, and platelet disorders were excluded from study.

Observation

Out of total 400 anemic samples 153 samples were from Males and 247 samples were from females and 1:1.6 is the gender ratio of the study.

Results are given in tabulated form started from Table no. 1 to Table no. 3

Table 1: Age and gender distribution in the present study.

Age range	10-20	21-30	31-40	41-50	51-60	61-70	Overall
Number of Male	09	31	56	28	19	10	153
Number of Female	11	64	94	43	21	14	247

Table no. 1 shows that there is female dominance in anemia cases and most of the anemic cases falls in age group of 21-30 yrs and 31-40 yrs.

Table 2: Distribution of anemia cases based on the findings of automated analyzer.

Morphological type of anemia	Microcytic Hypochromic Anemia with normal RDW	Microcytic Hypochromic Anemia with raised RDW	Normocytic Normochromic Anemia with normal RDW	Normocytic Normochromic anemia with raised RDW	Macrocytic Anemia
Number of cases	19	182	131	45	23

Table no. 2: Shows that maximum number of cases belongs to microcytic hypochromic type with raised RDW followed by Normocytic Normochromic Anemia with normal RDW.

Table 3: Distribution of anemia cases based on the findings of PBS examination

S. No.	Type of anemia	Number of cases (Percentage)
1	Microcytic hypochromic	208 (52.0%)
2	Macrocytic	23 (5.8%)
3	Normocytic normochromic	131 (32.8%)
4	Dimorphic	38 (9.5%)

Table no. 3: Shows that maximum number of cases belongs to microcytic hypochromic blood picture followed by normocytic normochromic blood picture.

After PBS examination there is change in typing in cases of normocytic normochromic anemia with raised RDW, out total 45 cases, 7 cases were turned out as microcytic hypochromic anemia and rest 38 cases were showing dimorphic blood picture. Here PBS examination is taken as gold standard. Our study shows that in 88.75% of cases anemia is correctly typed by the automated analyzer.

Discussion

Present study of 400 anemic cases showed that there is female preponderance in the anemia cases. Majority of females belongs to reproductive age group and it seems that pregnancy and menstruation also contribute in the amount of anemia. Many researchers have done studies on anemia in pregnant females and stated that poverty, lack of awareness, improper nutrition and delayed diagnosis and scarcity of proper health care facility in peripheral areas, these all are the major factors producing increase number of anemia in pregnant females [8, 9, 10, 11]. In anemia cases most of the cases were having microcytic hypochromic anemia and which is in majority of cases is iron deficiency anemia (Nutritional anemia).

We found that automated hematology analyzer gives results with 100 percent sensitivity in diagnosis of anemia and in 355 cases (88.75%) correctly classified the anemia. In PBS examination size of the RBC was compared to the size of the small lymphocyte nucleus; normally they are of same size. If size is decreases we called it microcytosis and if increases than the size of small lymphocyte nucleus than it is of macrocytic type. Out of 45 cases of normocytic normochromic anemia with raised RDW showed by the analyzer, we observed that in 7 cases peripheral blood smear examination shows that actually these are the cases of microcytic hypochromic anemia. And in rest of the 38 cases blood picture showed dimorphic blood picture which means RBC of two sizes (either microcyte and normocyte or microcyte and macrocytes) were seen.

Automated hematology analyzers decreases the load of hematology laboratories and routinely used by pathology laboratories. Hemoglobin, Blood counts (RBC count, WBC count, Platelets) and RBC indices (PCV, MCV, MCH, MCHC) given by analyzers are reliable and majority of cases comment on RBC morphology are also useful. Due to the use of hematology analyzers there is significant reduction in the number of manual slide review [12, 13, 14, 15]. PBS examination gives accurate morphological classification of anemia and by manual review many RBC abnormalities are also diagnosed. Many studies were done by previous researchers like Gulati GL *et al.* [16], Adewoyin AS *et al.* [17] and El Kerdany TA *et al.* [18] they also interpreted the same finding.

Conclusion

Automated hematology analyzers have reduced our work and they are very much useful for screening purposes and PBS examination have definite role in diagnosis and classification of anemia. Both diagnostic methods are complementary to each other.

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