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A Study of Blood Cell Indices and Reticulocyte Count in cases of Anaemia in Females in Reproductive Age Group

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Abstract

Introduction: ANAEMIA, a global health problem mostly affects the women of reproductive age group; especially in developing countries[1,2]. Whereas severe anaemia is closely related to risk of mortality even mild anaemia carries health risks and causes morbidity. So much information can be obtained from examination of the stained blood film and haematological parameters obtained from cell counter; that it is possible to reach to a tentative diagnosis of the type of anaemia in 90% of patients and special tests may not be required. **Material and Methods:** A study was carried out in 195 female patients in the age group of 16–50 yrs with haemoglobin values of less than 12gms%. E.D.T.A. blood samples were processed for haematological parameters on Electronic cell counter. Detailed smear examination and reticulocyte count was also done for each patient. The values of blood cell indices, RDW, reticulocyte count and haemoglobin were analyzed and corelated. **Results and Conclusions:** The mean age of females in the study was 28.5 yrs, of which 63 Patients were of mild anaemia, 100 patients were in category of moderate anaemia and 32 patients were classified as severe anaemia cases. PCV, MCV, and MCH were significantly altered in all cases whereas MCHC did not show a significant relation. Marked RDW alterations were seen in severe anaemia. Reticulocyte count was increased in only 13 out of 195 cases. Using classification given by David Bessman et al [3]; the predominant anaemia was nutritional; of which most cases were of iron deficiency with the rest being either Folate, Vitamin B12 deficiency mixed deficiency and chronic disease. Thus a detailed baseline study of haematological parameters can help us diagnose type of anaemia without availing the need of special tests.

Keywords: Anaemia, Females, Blood Cell Indices, Reproductive, Reticulocyte Count

1. Introduction

Anaemia is a global health problem seen mainly in developing countries. Women of reproductive age group are the most affected. Anaemia is functionally defined as insufficient RBC mass to adequately deliver oxygen to peripheral tissues[4]. Anaemia is present when the haemoglobin level in the blood is below the lower extreme of the normal range for the age and sex of the individual[5]. Nutritional anaemia is a serious problem in pregnancy which affects 60 to 70 percent of pregnant women. In pregnancy anaemia has significant impact on health of the

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foetus as well as that of the mother. So much information can be obtained from examination of peripheral stained blood smear, various haematological parameters obtained from cell counter and reticulocyte count; that it is possible to reach to a tentative diagnosis of the type of anaemia in 90% of the patients. Thus the need of special tests may be significantly reduced. The aim of this study is to corelate Haemoglobin (Hb) with Mean Corpuscular Volume (MCV), Mean Corpuscular Haemoglobin (MCH), Mean Corpuscular Haemoglobin Concentration (MCHC), Red Cell Distribution Width (RDW), Reticulocyte count. Along with these data and a detailed study of Peripheral blood smear an attempt has been made to arrive at causative factor of anaemia in females of reproductive age group as it is well known that anaemia is a sign of many diseases.

2. Material and Methods

This study was carried out in our institute: a tertiary health care Hospital. A total of 195 female cases were studied.

All females with haemoglobin less than 12 gms% and in reproductive age group (16–50yrs) were included in the study. Blood was collected from indoor and outdoor patients in E.D.T.A. Ethylenediaminetetraacetic acid) bulbs. These samples were run on electronic cell counter (ERMA) and all haematological parameters were noted. Peripheral blood smear was prepared in all cases. These smears were stained by Field's[6] stain after fixation. The smears were then examined by the Pathologist under 40X (high power) and 100X (oil immersion). The detailed smear report was prepared which included differential count, platelet adequacy and with special emphasis on RBC morphology. Reticulocyte count was done on all 195 samples.

3. Results

The haematological parameters, reticulocyte count and peripheral blood smear picture was studied in each of the 195 cases of anaemia in females in reproductive age group.

The mean age of females in the study was 28.5 yrs with minimum age of 18 yrs and maximum age of 49 yrs.

The cases were then categorised into three categories. Mild anaemia (Hb: 10–12 gms%) Moderate anaemia (7–9.9 gms%) and severe anaemia (Hb less than 7 gms%).

Out of 195 cases 63 cases were of mild anaemia, 100 patients were of moderate anaemia whereas 32 patients had severe anaemia.

In all categories of anaemia, the total count and platelet count were in normal range (Table 1). Cases of severe anaemia (15/32) were seen more in the age group of 20–29 yrs. Using the Pearson Corelation coefficient test it was found that there is positive correlation between haemoglobin and blood cell indices like PCV (Packed Cell volume), MCV, MCH and MCHC. Whereas negative corelation is shown between haemoglobin and RDW and MPV (Table 2).

In the present study, MCV was decreased in 23 cases (37%), normal in 39 (62%) and increased in 1 case (1%) of mild anaemia. MCV was decreased in 51 cases (51%), normal in 46 cases and increased in 3 cases of moderate anaemia. MCV was decreased in 22 cases (69%) normal

Table 1. Descriptive statistics of characteristics of 3 groups in the study sample (N= 195)

	SEVERE Hb< 7 gms/dl N==32	Moderate Hb 7 – 9.9 gms/dl	MILD Hb 10 – 12 gms/dl
Characteristics	Mean + S.D.	Mean + S.D.	Mean + S.D.
Hb	5.73 + 1.07	8.69 + 0.82	10.73 + 0.43
Total WBC Count	6275 + 2499	8357 + 4125	7756 + 3103
Total RBC Count	3.24 + 1.05	3.80 + 0.60	4.163 + 0.60
PCV/HCT	20.89 + 4.16	28.70 + 4.30	33.09 +4.21
MCV	69.92 + 16.46	76.05 + 8.99	80.09 + 9.48
MCH	19.60 + 5.34	23.35 + 4.07	26.02 + 3.51
MCHC	27.94 + 4.22	30.72 + 4.94	32.77 + 4.32
RDW	17.284 + 2.10	15.59 + 2.18	14.906 + 1.43
RETIC Count	1.94 + 1.47	0.88 + 0.74	0.502 + 0.47

Table 2. Corelation between HAEMOGLOBIN with following blood indices in 195 sample study

Sample study N	195	195	195	195	195
Haemoglobin	Pcv/Hct	MCV	MCH	MCHC	RDW
Pearson Corelation Co-efficient value	0.768	0.289	0.486	0.367	-0.353
EXACT significany 2 – tailed	0.0000**	0.0004*	0.0000**	0.0000**	0.0000**
P value	P< 0.01	P< 0.01	P< 0.01	P< 0.01	P< 0.01
INTERPRETATION	Highly significant	Highly significant	Highly significant	Highly significant	Highly significant

Note ** Corelation is significant at 0.01 level (2- tailed)
* Corelation is significant at the 0.05 level (2 - tailed)

in 8 cases (25 %) and increased in 2 cases (6 %) of severe anaemia.

MCH was decreased in 37 cases (59%), normal in 22 cases (35%) and increased in 4 cases (6%) of mild anaemia. It was decreased in 85 cases (85%), normal in 11 cases (11%) and increased in 4 cases (4%) of moderate anaemia. MCH was decreased in 31 cases (97%) and increased in 1 case (3 %) of severe anaemia.

MCHC was decreased in 20 cases (31.7%), normal in 35 cases (55.5 %) and increased in 8 cases (12.7%) of mild anaemia. MCHC was decreased in 69 cases (69%), normal in 17 cases (17%) and increased in 14 cases (14%) of moderate anaemia. MCHC was decreased in 26 cases (81.2%), normal in 3 cases (9.38%) and increased in 3 cases (9.38 %) of severe anaemia.

RDW was normal in 16 cases (25.4%) and increased in 47 cases of mild anaemia. RDW was normal in 3 cases (9.38%) increased in 97 cases (97%) and decreased in 1 (1%) of moderate anaemia. RDW was normal in 3 cases (9.38%) increased in 29 cases (90.63%) of severe anaemia.

Reticulocyte Count (Retic Count) was normal in 23 cases (36.5%) and was low in 40 cases (63.5%) of mild anaemia. Retic Count was normal in 77 cases (77%), increased in 4 cases (4%) and low in 19 cases (9%) of moderate anaemia. It was normal in 20 cases (62.5%), increased in 9 cases (28.12%) and low in 3 cases (9.4%) of severe anaemia.

RBC Count was normal or decreased in all cases of anaemia; except for a single case of mild anaemia.

Using Improved classification of anaemia by MCV and RDW by David Bessman et al. (Tables 3–5) In cases of mild anaemia (Hb 10–12 gms/dl): Normocytic homogenous (MCV Normal RDW Normal) – 33 cases.

Table 3. Comparison of MCV and RDW

(Mild anaemia Hb 10 – 12 gms/dl)

MCV	RDW	
	Normal	Increased
Normal	33	6
Decreased	8	15
Increased	1	0

Table 4. Comparison of MCV and RDW

(Moderate anaemia Hb 7 – 9.9 gms/dl.)

MCV	RDW	
	Normal	Increased
Normal	21	26
Decreased	9	42
Increased	0	2

Table 5. Comparison of MCV and RDW

(Severe anaemia : Hb less than 7 gms/dl)

MCV	RDW	
	Normal	Increased
Normal	6	2
Decreased	1	21
Increased	0	2

Normocytic heterogenous (MCV Normal RDW High)-6 cases.

Microcytic homogenous (MCV–Low, RDW Normal)-8 cases Microcytic Heterogenous (MCV Low, RDW High)-15 cases Macrocytic with normal RDW- 1 case. In cases of moderate anaemia (Hb 7 – 10 gms/dl):

Normocytic homogenous (MCV Normal RDW Normal)–21 cases.

Normocytic heterogenous(MCV Normal RDW High)-26 cases Microcytic homogenous (MCV –Low, RDW Normal)-9 cases Microcytic Heterogenous (MCV Low, RDW High)-42 cases Macrocytic with increased RDW-1 case In cases of severe anaemia (Hb < 7 gms/dl):

Normocytic homogenous (MCV Normal RDW Normal)–6 cases. Normocytic heterogenous(MCV Normal RDW High)-2 cases Microcytic homogenous (MCV–Low, RDW Normal)-1 case Microcytic Heterogenous (MCV Low , RDW High)-21 cases Macrocytic with increased RDW- 2 cases.

4. Discussion

Careful qualitative and quantitative assessment of RBC not only helps in evaluating and diagnosing anaemia, but it also leads us to the causative disorder. While examination of peripheral blood smear yields diagnostic information of RBC morphology, Blood cell indices gives us quantitative assessment of RBC's. Both in union allow us to reach to a differential diagnosis and can thus help us to ask only the required special tests rather than a broad list of investigations[4].

Advent of automated haematology cell counters has not only improved accuracy and precision; but has also reduced subjective errors[7]. Out of study sample of 195 cases, we categorised them on the basis of haemoglobin as mild (10-12) Gms/dl , moderate (7–9.9 gms/dl) and severe (7 gms/dl) according to WHO Classification[8].

The majority of cases were in the age group of 15–29 yrs which is active reproductive life especially in developing countries. This correlated with the study of BC Mehta[9] and NFHS-3 survey[10]. The high percentage of anaemia in this age group may be because of nutritional deficiencies, pregnancies and various gynaecological and obstetrical problems[11]. In present study 49.23 of patients had decreased MCV, 49.69% had normal MCV and 3.01% had increased MCV. MCV values were lowest in cases of severe anaemia (Table No.1). MCH values also showed similar picture like MCV. However, MCHC values did not show significant correlation with haemoglobin. MCHC is an indicator of fairly advanced hypochromia and is the last parameter to fall in iron deficiency anaemia according to Wintrobe[4]. This is confirmed by study by Ryan[12].

In our study 173/195 females 88.72% had increased RDW, 21 females (10.77%) had normal RDW and only one female showed a lower value of RDW (0.51%).Mean RDW was comparatively high in women with severe anaemia than those having mild and moderate anaemia. Similar observations were made by Vishwanath et al.[13] and Carmen et al[14].

According to Kook in Park et al.[15] nutritional deficiency whether iron, folate or vitamin B12 always causes increased RDW.

According to Menzon et al.[16] Bessman's Classification based on combination of MCV and RDW established useful differential diagnosis of RBC disorders.

According to Ernest Beutler et al.[17] study of blood cell indices were superior to examination of stained smears in mildly anaemic patients.

The improved classification of anaemias by Bessman et al.[3] is as follows:-

1) Microcytic homogenous (MCV–Low ,RDW– Normal)
a) Heterozygous thalassemia*
b) Chronic disease.*

2) Microcytic Heterogenous (MCV–Low, RDW–High)
a) Iron deficiency anaemia
b) B- thalassemia
c) Haemoglobin–H
d) Red Cell fragmentation

3) Normocytic homogenous (MCV–Normal, RDW–Normal)
a) Normal
b) Chronic disease*
c) Chronic liver disease *+
d) Non anaemic haemoglobinopathy
e) Transfusion +
f) Chemotherapy
g) CLL
h) CML +
i) Hereditary Spherocytosis.

4) Normocytic, Heterogenous (MCV – Normal, RDW – High)
a) Mixed deficiency*
b) Early iron or folate deficiency
c) Anaemic haemoglobinopathy
d) Myelofibrosis
e) Sideroblastic*

5) Macrocytic, Homogenous (MCV – High, RDW – Normal)
a) Aplastic anaemia
b) Preleukaemia +

6) Macrocytic Heterogenous (MCV – High, RDW – High)
a) Folate or Vitamin B 12 deficiency *
b) Immune haemolytic anaemia
c) Cold agglutinin
d) CLL

*MCV alone less than 90 % sensitive. + RDW alone less than 90% sensitive

Thus using the classification described by Bessman et al.[3] 78 cases out of 195 cases showed reduced MCV with increased RDW. However RBC and Retic Count were normal. So most of these cases were probably of Iron deficiency anaemia.

34 cases showed normocytic heterogenous picture i.e. MCV Normal RDW High. As RBC count, Retic Count were normal with no abnormality of RBC's and WBC's, the most common cause here is probably mixed deficiency or early folate or iron deficiency.

Similarly 60 cases of normocytic homogenous picture were either due to blood loss or chronic disease. 18 cases of microcytic homogenous picture suggest that the anaemia is due to chronic disease or early iron or folate deficiency as RBC Count was not raised or decreased.

There were 5 cases of macrocytic anaemia of which 4 cases were most likely to be caused by Vitamin B12 or Folate deficiency.

Similar results were seen in a study by Walker et al.[18]

5. Conclusion

Thus a detailed study of blood cell indices and correlation with RDW, Reticulocyte Count and Peripheral smear examination will help us in reaching diagnosis without availing the need of special tests.

6. References

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