Original Research Article

Evaluation of haematological parameters and categorisation of anemia in adults in a tertiary care hospital

M K Vedashree[1],*

[1]*Dept. of Pathology, Chamarajanagar Institute of Medical Sciences, Chamarajanagar, Karnataka, India*

ARTICLE INFO

ABSTRACT

Anemia is a common haematological condition in India among women and children. It requires proper evaluation of hematological parameters for assessing the severity and type of anemia. The modern automated haematological analysers are capable of providing adequate information necessary for the anaemia evaluation.

Aim: To study the severity and type of anemia in adults in a tertiary care hospital based on Red blood cell parameters.

Objectives: 1. To collect the haematological parameters of patients with low haemoglobin percent values; 2. To analyse the various red cell indices and study the age and sex wise distribution; 3. To classify anemia based on red cell indices and grade anemia based on WHO guidelines.

Materials and Methods: This retrospective study was carried out in department of Pathology, Chamarajanagar institute of medical sciences, teaching associated district hospital laboratory, for a period of 3 months from October 2016 to December 2016. The study included 105 cases with low haemoglobin percent in fully automated hematology analyser which was correlated with red cell indices parameters. The severity and the type of anemia were analysed and compared with other similar studies.

Results: In the present study, there was predominance of anemia in 2nd decade among female s with microcytic hypochromic type being common. Maximum number of patients were in the age group of 21-30 years and had mild degree of anemia followed by moderate and severe degree of anemia. Based on red cell indices, the morphological type of anemias were studied in relation to the age and sex of the patients.

Conclusion: Anemia being a common hematological condition requires proper evaluation of the hematological parameters in assessing the type and severity.

1. Introduction

Anemia is a common clinical condition with reduction in haemoglobin concentration for the age, sex and physiological condition.[1] It is classified based on the morphological characteristics which include the red cell size, degree of hemoglobinization and shape of red blood cells(RBCs).[2] Anemia is the manifestion of an underlying disease. Typing of anemia and further workup include evaluation of haemoglobin and RBC indices which include mean corpuscular volume (MCV), mean corpuscular haemoglobin (MCH), mean corpuscular haemoglobin concentration (MCHC).[3] The haemoglobin concentration is the most commonly used parameter of anemia.[4] Modern instruments are capable of counting and estimating the size of circulating blood cells.[5,6] It is based upon the generation of an electrical pulse when a blood cell passes through a small a perture surrounded by electrode.[7] Each electrical pulse generated represents an individual cell and the pulse height corresponds to the cell volume. The measured variables of RBCs thus provided are haemoglobin, hematocrit, MCV and Red cell distribution width.[8,9] The evaluation of RBC parameters like Hemoglobin, Hematocrit and R BC indices helps in characterising the type of anemia and formulation of

---

* *Corresponding author.*
  E-mail address: pathomkvedashree@gmail.com (M. K. Vedashree).

differential diagnosis.[3] The levels of haemoglobin vary in different pathological conditions ranging from infections to inflammatory processes.[10] Thus estimation of haemoglobin is also useful in diagnosing the underlying disease process. The diagnostic accuracy of classifying anemia is highest when the RBC parameters like MCH, MCV and MCHC are evaluated.[11] Thus the entity of RBC parameters is of significant value in diagnosis and evaluation of anemia.

2. Aim

To study the prevalence of anemia in adults in a tertiary care hospital demographically.

3. Objectives

1. To collect the haematological parameter of patients who showed abnormal red cell indices.
2. To analyse the various red cell indices and correlate with haemoglobin percent.

4. Materials and Methods

This retrospective study was carried out in department of Pathology, Chamarajanagar institute of medical sciences, teaching associated district hospital laboratory for a period of 3 months from October 2016 to December 2016.

4.1. Inclusion criteria

Patients in the age group of 18–60 years with haemoglobin less than normal range for the age and sex.

4.2. Exclusion criteria

1. Patients less than 18 years of age and more than 60 years.
2. Patients with anemia associated with other hemotological abnormalities.

The study included 105 cases which showed low haemoglobin percent in fully automated blood cell counter-model PCE-210 and then correlated with red cell indices parameters. The severity of anemia was graded based on the haemoglobin concentration (gm/dl) according to World Health Organisation guidelines (WHO guidelines) (Table 1). The type of anemia was studied based on the red cell indices. The distribution of severity and type of anemia was studied in each age and sex group. The study was then compared with other studies. The severity of anemia was graded based on WHO the cut off range of haemoglobin concentration.

5. Observation and Results

We studied 105 cases which showed low haemoglobin percentage in automated blood cell counter. Out of

Table 1: Normal range of Hemoglobin concentration (gm/dl) for grading severity of anemia (WHO guidelines)

	Mild	**Moderate**	**Severe**
Female	11 – 11.9	8 - 10.9	<8
Male	11 – 12.9	8 – 10.9	<8

Table 2: Normal values of RBC indices (WHO guidelines)

MCV	**MCH**	**MCHC**
80 – 100 fl	27-32 pg	32-36 gm/dl

105 cases 79(75.23%) were female and 26(24.76%) were males as shown in Table 3. The severity of anemia was assessed based on the range of haemoglobin percentage as mild, moderate and severe as shown in the Table 1. Based on the severity of anemia, 52 patients had mild degree with 39 female patients (37.14%), 13 male patients (12.3%), 27 patients had moderate degree with 14 female patients(13.4%), 13 male patients(12.3%) followed by 26 female patients(24.76%) had severe degree of anemia.

There was female preponderance in all degrees of anemia. The age range in our study was 21 to 50 years with the maximum number of cases of anemia between 21 to 30 years. Based on red cell indices, the morphological type of anemias were studied in relation to the age and sex of the patients. Patients with normal MCV and MCH were categorised as normocytic and normochromic. Patients with low MCV and low MCH were categorised as microcytic and hypochromic respectively. Patients with low MCV and normal MCH were categorised as microcytic and normochromic. There were no patients with high MCV in our study. 85 cases had normal MCHC values and the remaining 20 patients had decreased values as shown in Table 6. Microcytic hypochromic anemia was the most common morphological type constituting 60(57.07%) patients followed by normocytic normochromic constituting 26(24.76%) patients. The distributions of age group based on morphological type of anemia are as shown in Table 4.

6. Discussion

Anemia is the reduction in the haemoglobin levels and implies the manifestion of various pathological conditions. Thus evaluation of anemia aids in diagnosing the various disease processes and guides in efficient management of patients. The basic parameters that are helpful in evaluation are haemoglobin, and RBC indices. The present study was conducted on 105 patients and the results were obtained by the fully automated blood cell counter. Most of the patients in this study were female in the age group of 21-30 years and the most common type of anemia was microcytic hypochromic. This is similar to the study conducted by Reena Kouli et al which was done on 1330 cases[12] in tertiary care centre of north east India and study by S.Patel in

Table 3: Sex distribution of anemia cases based on morphology

Morphology	Male	Female
Microcytic hypochromic	6(5.7%)	53(50.4%)
Normocytic normochromic	6(5.7%)	20(19.04%)
Microcytic normochromic	6(5.7%)	14(13.3%)
Marcocytic	0(0%)	0(0%)

Table 4: Age distribution of anemia cases based on morphology

Morphology	21 – 30 yrs	31-40 yrs	41-50 yrs
Microcytic hypochromic	28(26.6%)	19(18.09%)	13(12.38%)
Normocytic normochromic	13(12.38%)	-	13(12.38%)
Microcytic normochromic	19(18.09%)	-	-
Marcocytic	-	-	-

Table 5: Age–wise distribution of anemia cases based on severity

	Mild	Moderate	Severe
21-30 yrs	20(19%)	20(19%)	20(19%)
31-40 yrs	0(%)	13(12.3%)	7(6.7%)
41-50 yrs	13(12.3%)	6(5.7%)	6(5.7%)

Table 6: MCV, MCH and MCHC distribution

	Normal	Reduced	Increased
MCV	26(24.7%)	78(74%)	0(0%)
MCH	46(43.8%)	59(56.1%)	-
MCHC	85(80.9%)	20(19.04%)	-

Gujarat.[13] In our study, 26(24.76%) male and 79 (75.23%) female had anemia which i s similar to the study by Reena Kouli et al[12] but in contrast to study by Gerardo Alvarez-uria et al[14] which showed 50.55% males and 49.45% females. In our study, among females mild degree of anaemia (37.14%) was more common followed by severe and moderate degree in contrast to the study by Reena Kouli et al which showed moderate degree of anaemia (47.2%) to be more common in females followed by mild and severe degree. Our study showed equal distribution of mild and moderate degrees of anemia among males and no patients had severe degree i n contrast to study by Reena Kouli et al which showed more number of males patients having moderate degree of anemia followed by mild and severe degree.

7. Conclusion

Anemia is considered as one of the most common hematologic abnormality. It is more common in India. The early diagnosis and classification helps in timely intervention and treatment thus reducing the morbidity associated with it. The utility of haematological parameters obtained from automated cell counters aids in increased diagnostic accuracy. In the present study, there was predominance of anemia in 2nd decade among females and microcytic hypochromic type was common. Also the study showed maximum number of mild degree of anemia. Thus the combination of various RBC parameters and haemoglobin percentage provides adequate information of the haematological profile.

8. Source of funding

None.

9. Conflict of interest

None.

References

1. A new concept in the control of iron deficiency: Community based preventive supplementation of at - risk groups by weekly intake of iron suppliments. *Biomed Environ Sci*. 1998;(1):46–60.
2. Kumar V, Abbas AK, Fausto N. Red blood cell and bleeding disorders. In: Robbins and Cotran pathologic basis of disease ; 2010,. 8th ed.
3. Mukhopadhyay D, Mohanruban K. Iron deficiency anaemia in older people: investigation, management and treatment. *Age Ageing*. 2002;31(2):116–117. Age Ageing.
4. Iron deficiency anaemia: assessment, prevention and control. A guide for programme managers. WHO. Geneva ; 2001,. .
5. Rappaport ES, Helbert B, Beissner RS, Trowbridge A. Automated hematology: where we stand. *South Med J*. 1988;81:365–370.
6. Gulati GL, Hyun BH. The automated CBC: a current perspective. *Hematol Oncol Clin North Am*. 1994;8:593–603.
7. Tefferi A, Hanson CA, Inwards DJ. How to interpret and pursue an abnormal complete blood cell count in adults. *Mayo Clin Proc*. 2005;80(7):923–936.

8. Behrens JA, Brown WP, Gibson DF, Detter JC. Whole-blood hemoglobin determinations: a comparison of methodologies. *Am J Clin Pathol*. 1979;72:904–908.

9. Hemoglobin and hematocrit: an analysis of clinical accuracy: case study of the anemic patient. *ANNA J*. 1998;25:83–86.

10. Wintrobe MM. Hematologia Clinica. Manole; Sao Paulo ; 1998,.

11. Jadhav MV, Agarwal SA, Kadgi NV. Utility of automated RBC parameters in evaluation of anemia. *Int J Healthcare Biomed Res*. 2015;3:170–181.

12. Kouli R, Pegu AK, Teronpi J. Study of anemia in correlation with hematological parameters among adults in a tertiary care centre of North-East India. *Int J Med Res Prof*. 2016;2(4):84–87.

13. Patel S, Shah M, Patel J. Iron deficiency anemia in moderate to severely anaemic patients. *Gujarat Med J*;64:15–18.

14. Alvarez-Uria G. Prevalence and severity of anaemia stratified by age and gender in rural India ; 2014,.

Author biography

M K Vedashree Assistant Professor