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Original Research Article

An Assessment of the Morphological Types of Anaemias and Their Correlation with the RBC and Platelet Parameters: An Observational Study

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Abstract

Aim: The aim of the present study was to assess the morphological types of anaemias and their correlation with the RBC and platelet parameters.

Methods: The present study was conducted in the haematology wing, Department of Pathology, It was a descriptive and cross sectional study done over a period of 10 months with 500 cases.

Results: The age group of the patients included in this study ranged from 14 years to 75 years. Most common age group affected by anaemia belonged to 31-40 years age group constituting 24%. Females were affected more than males. Based on RBC indices given by autoanalyzer and peripheral smear examination, anaemic patients were divided into six morphological subtypes. Maximum number of patients (280/500) was in the group of Microcytic Hypochromic Anaemia (MHA) with raised Red cell Distribution Width (RDW). Other morphological subtypes of anaemia reported were Normocytic Normochromic Anaemia (NNA) with normal RDW (100/500), Microcytic Hypochromic Anaemia with normal RDW (60/500), Normocytic Normochromic Anaemia with raised RDW (35/500), Macrocytic anaemia (15/500) followed by Dimorphic anaemia (10/500). The study of RBC indices in different anaemias in our study showed that RDW was commonly increased not only in microcytic anaemias but also in macrocytic anaemias. The mean haemoglobin was significantly low in both micrtocytic and macrocytic anaemias. Distribution of platelet indices showed that the mean platelet count was the highest in microcytic anaemias. It was also noted that the Mean platelet volume (not count) / Platelet count ratio was higher in microcytic anaemias.

Conclusion: A good knowledge of the variation in RBC indices, RDW and platelet /mean platelet volume ratio along with a peripheral smear can help the reporting haematologist identify early stages of iron deficiency anaemia and can give a precise and accurate anaemia categorization at the basic entry level of laboratory investigation.

Keywords: Anaemia, Microcytic, RDW, Mean platelet volume, Platelet indices, Analyzers

Introduction

Anemia is a condition described by insufficient red blood cells or based on hemoglobin content in the blood below a specific range estimated for specific sex and age of a person. Anemia is diagnosed using PBS where microscopic examination of blood smear provides useful information about alteration of RBC shape and size or presence of any inclusion bodies. RBC morphology is a key tool for hematologists to recommend appropriate clinical and laboratory follow-up and to select the best tests for definitive diagnosis. Anemia analysis can be done based on RBC morphology and clinical parameters. Morphological analysis using blood smear is performed by spreading a drop of blood thinly onto a glass slide and stained with coloring agents such as Giemsa, Leishman, and Wright-Giemsa and examined under a microscope by a qualified lab technician. [1] The blood smear contains different types of cells, namely White Blood Cells (WBCs), RBCs and platelets.

The platelet count > 4,50,000/µl in the peripheral blood sample is referred to as thrombocytosis, by the rampant usage of electronic cell counters diagnosis

of thrombocytosis is made easily and more often observed as an unexpected finding. [2,3] In the peripheral blood, numerous disease conditions can lead to increased platelet count. The causes may be primary in elderly patients due to myeloproliferative disorders or secondary to infection or inflammation. [4] Reactive thrombocytosis has to be differentiated from primary or clonal platelet disorders which are neglected many times which are of practical clinical importance and a diagnostic challenge. However, the distinction is not always made with certainty, and the diagnosis often depends on observing the platelet count over a period of time following the treatment. [5] The commonest non- infectious cause of secondary thrombocytosis is iron deficiency anaemia. Thrombocytosis is either due to a reactive process (Secondary) or because of clonal disorders (primary thrombocytosis). It is critical concern to distinguish, because thrombo-haemorrhagic complications are frequent in clonal rather than reactive thrombocytosis. [6,7]

The aim of the present study was to assess the morphological types of anaemias and their correlation with the RBC and platelet parameters.

Materials and Methods

The present study was conducted in the haematology wing, Department of Pathology, Nalanda Medical College and Hospital, Patna, Bihar, India. It was a descriptive and cross sectional study done over a period of 10 months with 500 cases.

Inclusion Criteria

All cases of anaemia (Haemoglobin <11 gm%) from both the sexes with age more than 15 years were included in the study.

Exclusion Criteria

Cases with leucocytosis, leukemaiod reaction, leukemia, parasite, platelet disorders were excluded from the study.

Method of Collection of Data

The venous blood samples were collected from patients in Ethylene Diamine Tetracetic Acid (EDTA) vacutainers with request of complete blood count and complete haemogram sent from different clinical departments. The samples were run in the three part haematology analyser ERBA H360. Daily quality checks were done as per standard protocols. Of the total 3072 samples received for the above tests during the study period, 520 samples fitted into the inclusion criteria. RBC, platelet parameters and histograms of the 520 cases were noted. Peripheral smears were prepared for the same and stained by Leishman stain. The parameters were correlated with peripheral smear findings and histograms as given by the autoanalyzer. Categorization of anaemia was done based on combination of smear and autoanalyzer findings.

Statistical Analysis

Descriptive statistics like frequencies, percentages were used to describe the characteristics of study population. Measure of central tendency such as mean was computed for various parameters (RBC and Platelet indices).SSPS software version 21 was used.

Results

Table 1: Age and gender distribution

Age group in years	Male	Female	Total
11-20	15	35	50
21-30	18	92	110
31-40	32	88	120
41-50	10	90	100
51-60	13	47	60
61-70	10	30	40
>70 years	2	18	20
Total	100	400	500

The age group of the patients included in this study ranged from 14 years to 75 years. Most common age group affected by anaemia belonged to 31-40 years age group constituting 24%. Females were affected more than males.

Table 2: Distribution of different types of anaemia

Types of anemia	N%
Microcytic Hypochromic Anaemia with raised RDW	280 (56%)
Normocytic Normochromic Anaemia with normal RDW	100 (20%)
Microcytic Hypochromic Anaemia with normal RDW	60 (8%)
Normocytic Normochromic Anaemia with raised RDW	35 (7%)
Macrocytic anaemia	15 (3%)
Dimorphic anaemia	10 (2%)

Based on RBC indices given by autoanalyzer and peripheral smear examination, anaemic patients were divided into six morphological subtypes. Maximum number of patients (280/500) was in the group of Microcytic Hypochromic Anaemia (MHA) with raised Red cell Distribution Width (RDW). Other morphological subtypes of anaemia reported were Normocytic Normochromic Anaemia (NNA) with normal RDW (100/500), Microcytic Hypochromic Anaemia with normal RDW (60/500), Normocytic Normochromic Anaemia with raised RDW (35/500), Macrocytic anaemia (15/500) followed by Dimorphic anaemia (10/500).

Table 3: Distribution of RBC indices in different types of anaemia

Types of anaemia		MHA	NNA	Macrocytic anaemia	Dimorphic anaemia
RBC (millions/cumm)	Max	6.24	3.77	5.04	4.96
Mean		4.46	2.38	3.57	3.67
Min		2.2	5.3	8.3	5
Haemoglobin (g/dl)	Max	12	10.8	10.6	11
Mean		8.6	8.4	9.3	9.6
Min		7.7	16	24.6	12.3
Haematocrit (%)	Max	34.6	31.8	33.7	34
Mean		28.2	25.2	28.2	29.3
Mean Corpuscular Volume	Min	45.5	92.1	66.4	69.1
(fl)	Max	78.2	112.3	93.7	97.3
Mean		64.6	103.8	84.1	80.3
Mean Corpuscular	Min	2.9	21.3	21.1	21.5
Haemoglobin (pg)	Max	52	42.6	32.6	38.4
Mean		18.2	34.6	28.5	27.3
Mean Corpuscular	Min	13.5	32.4	31.7	30.5
Haemoglobin	Max	36	44.6	35.5	38.4
Concentration (g/dl)	Mean	31	34.6	33.7	32.5
RDW Coefficient of	Min	3.2	12.3	2.8	12.4
Variation (%)	Max	27.3	24.6	15.2	22.8
Mean		15.8	16.1	12.7	14.04

The study of RBC indices in different anaemias in our study showed that RDW was commonly increased not only in microcytic anaemias but also in macrocytic anaemias.

Table 4: Distribution of platelet indices in different types of anaemia

Types of anaemia		MHA	NNA	Macrocytic anaemia	Dimorphic anaemia
Platelet Count (lakhs/mm)	Max	9.03	5	5	4.16
Mean		3.27	1.83	2.56	2.54
Min		7.3	4.76	4.79	8.2
Mean Platelet Volume (fl)	Max	13.6	11.5	11.6	11.3
Mean		9.2	9.5	9.4	9.3
Platelet Distribution Width	Min	2.2	7.8	7.8	9.2
Standard Deviation (fl)	Max	24.8	15.8	15.7	14.6
Mean		12	11.5	11.5	11
Platelet Distribution Width	Min	1.8	9.1	9.1	13.4
Coefficient of Variation (%)	Max	40.2	17.2	17.2	16
Mean		14.8	15.2	15.2	14.6
Min		0.046	0.07	0.05	0.125
Plateletcrit (%)	Max	0.745	0.45	0.43	0.370
Mean		0.295	0.175	0.178	0.232
Min		10.5	12.2	12.1	15.3
Platelet Large Cell Ratio	Max	80	38.2	38.4	36.8
Mean		23.7	25.5	25.4	23.1

The mean haemoglobin was significantly low in both micrtocytic and macrocytic anaemias. Distribution of platelet indices showed that the mean platelet count was the highest in microcytic anaemias. It was also noted that the Mean platelet volume (not count) / Platelet count ratio was higher in microcytic anaemias.

Discussion

Anaemia is a universal health issue affecting both developing and developed countries having major impact on human health as well as social and economic development. [8,9] The estimated prevalence of anaemia in developing countries like ours is 39% in children <5 years, 48% in children 5–14 years, 42% in women 15–59 years, 30% in men 15–59 years, and 45% in adults >60 years. 3 Presenting symptoms of anaemia being non – specific, and by itself it being a non- specific diagnosis, the initial morphological classification of anaemia & simultaneous correlation with red blood cell indices and morphological characteristics plays a crucial role in deciding the further clinical management. [10] With the advent of automation in haematology the red cell & platelet parameters given by the analyzers can be used to a large extent to subcategorize the various anaemias within a short time without any extra cost. In addition knowledge of interpretation of the Red Blood Cell (RBC) histogram can support the diagnosis of dimorphic anaemia of megaloblastic etiology. [11,12]

The age group of the patients included in this study ranged from 14 years to 75 years. Most common age group affected by anaemia belonged to 31-40 years age group constituting 24%. Females were affected more than males which were comparable to the study done by Hafizl F et al. [8] The age old classification of anaemia based on etiology and morphology till date remains unchanged as an indispensable tool for the initial evaluation of this non-specific diagnosis. [13] With the advent of automation in medical laboratory, haematology analyzers are capable of giving a wide variety of red cell and platelet indices precisely and accurately. At the same time, examination of a well stained peripheral smear is an indispensable tool that throws light on associated features of the blood elements. [14]

Based on RBC indices given by autoanalyzer and peripheral smear examination, anaemic patients were divided into six morphological subtypes. Maximum number of patients (280/500) was in the group of Microcytic Hypochromic Anaemia (MHA) with raised Red cell Distribution Width (RDW). Other morphological subtypes of anaemia reported were Normocytic Normochromic Anaemia (NNA) with normal RDW (100/500), Microcytic Hypochromic Anaemia with normal RDW (60/500), Normocytic Normochromic Anaemia with raised RDW (35/500), Macrocytic anaemia (15/500) followed by Dimorphic anaemia (10/500). Iron deficiency anemia is the most common cause among the non-infectious causes of secondary thrombocytosis. This approach nevertheless is not without dangers, because thrombo hemorrhagic complications are more common in clonal rather than reactive thrombocytosis. [15] Study done by Ramu. R et al [16] about iron deficiency anemia with thrombocytosis and erythropoietin levels also showed that majority of the cases in their study had moderate degree of anemia and presented frequently with mild thrombocytosis. Mehri T et al [17] reported that in normal individuals, MPV is inversely related to Platelet count. The reference values of MPV may differ with the platelet count. In majority of the cases of myeloproliferative disorders, MPV is usually increased. Platelet counts are unusually increased in primary myeloproliferative disorders than secondary thrombocytosis cases. PDW in both primary and secondary thrombocytosis also varies accordingly.

The study of RBC indices in different anaemias in our study showed that RDW was commonly increased not only in microcytic anaemias but also in macrocytic anaemias. The mean haemoglobin was significantly low in both micrtocytic and macrocytic anaemias. Distribution of platelet indices showed that the mean platelet count was the highest in microcytic anaemias. It was also noted that the Mean platelet volume (not count) / Platelet count ratio was higher in microcytic anaemias. The mean red cell volume of macrocytic anaemias in our study was 103 fl which is similar to other studies. [18,19] The most common cause of macrocytic anaemias are megaloblastic anaemia, alcoholism, liver disease and hypothyroidism. [20] The analyser can at times spuriously count the polychromatophilic cells and agglutinins as macrocytes, once again highlighting the importance of a peripheral smear examination as done in our study. Sandoval. C [21] and Nathiya S et al [22] defined that amidst of all the anemia types, anemia with iron deficiency most often presents with thrombocytosis and is more persistent in children below 2 years of age, because of the greater prevalence of iron deficiency in this age group. In this study more the severity of anemia was directly proportional to severity of thrombocytosis. The mean MPV and PDW were found to be higher in primary thrombocytosis when compared to secondary thrombocytosis.

Conclusion

In our routine reporting of peripheral smear examination, we come across many cases of increased platelet count in microcytic hypochromic anemia more often in iron deficiency anemia. It is of practical clinical importance to be readily able to distinguish between reactive and clonal

thrombocytosis. A good knowledge of the variation in RBC indices, RDW and platelet /mean platelet volume ratio along with a peripheral smear can help the reporting haematologist identify early stages of iron deficiency anaemia and can give a precise and accurate anaemia categorization at the basic entry level of laboratory investigation.

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