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Does red blood cell distribution width (RDW) improve evaluation of microcytic anaemias?

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Does Red Blood Cell Distribution Width. (RDW) Improve Evaluation of Microcytic Anaemias?

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Abstract

The red cell distribution width (RDW) is an index of the variation in red cells size (anisocytosis). A study was conducted to examine the validity of using RDW in improving classification of microcytic anaemias. A total of 300 blood samples collected from a patient population aged 3 months to 55 years who were referred for haemoglobin electrophoresis were examined at The Aga Khan University Hospital (AKUH). On complete blood count, initially 200 patients (66.6%) were found to have hypochromic microcytic anaemia. Following haemoglobin electrophoresis 41% (821200) patients were diagnosed to have thalassemia minor and 59% (1181200) had hypochromic microcytic anaemia with either a normal haemoglobin paltern or an abnormal haemoglobin. The mean (± SD) RDW estimated in 250 apparently healthy Pakistani population was 14 (+ 1.5%). Elevated RDW of 23% was present in 94% (110/118) of the patients with hypochromic microcytic anaemia due to other causes, whereas 48% (39/82) of the patients with thalassemia minor had elevated RDW of 16%. Also, of the 82 thalassemia minor, 28 patients had normal haemoglobin level, of which 6 had elevated RDW and of the 54 with low haemoglobin level, 35 had elevated RDW. RDW was normal in 41 patients with thalassemia minor trait. Our results suggest that RDW alone cannot be used as a reliable indicator to distinguish between thalassemia minor and other causes of microcytosis (JPMA 43:149, 1993).

Introduction

Iron deficiency is regarded as the leading cause of anaemia worldwide[1]. However, in a population where thalassemia is also prevalent, it is important to distinguish between these two common causes of microcytic anaemias. There are several expensive and elaborate ways to differentiate the two. In Pakistani population, B-thalassemia is more prevalent than other types of thalassemia. There have been reports that red blood cells distribution width (RDW), calculated as a standard statistical value, i.e., the coefficient of variation of the red cell volume distribution can be used to differentiate thalassemia and iron deficiency[2]. This study was carried out to determine how accurately RDW can be used to find out whether the microcytic anaemia is due to thalassemia or some other cause of microcytosis. Keeping in view the constraint of financial resources in a developing country and rather than carrying out several expensive tests, it was looked into whether a cheap and effective way could be devised to diagnose the case of thalassemia minor.

Patients and Methods

A total of 300 patients, aged 3 months to 55 years, who reported to The Aga Khan University Hospital Clinical Laboratories for haemoglobin electrophoresis were selected for the study. The study was carried out during the first seven months of 1989. All the hematological measurements were done on Coulter S + W auto— analyzer standardized using 4C Plus Coulter Counter cell control. Based on the results of MCV and MCH, the patients were classified as either having hypochromic microcytic anaemia, macrocytic anaemia or normochromic normocytic anaemia. Following WHO criteria, the accepted values of haemoglobin, MCV and MCH are 11 g/dl, 70 fi and 20 pg respectively. Cellulose

acetate electrophoresis was used to separate and identify the type of haemoglobins present[3] and identified by comparison to the band pattern of controls containing HbA, F, 5, C supplied by Helena Laboratories, Beaumont, Texas, USA. A total of 250 apparently healthy males and females having normal Hb were tested to estimate normal values for RDW, which was found to be 14 (±1.5%). Estimation of HbA2 was done by using Helena quick column method using DEAC cellulose chromatography[4]. Haemoglobin S/D estimation was done by agar gel electrophoresis and acid buffer system[5]. For identification of thalassemia trait, the formula for discriminate function DF = MCV - RBC -5 Hb - 3.4 of England and Fraser[6] was used.

Results

Frequency of different types of anaemia with mean and elevated RDW values are presented in Table I. On initial complete blood count of the total 300 cases, hypochromic microcytic anaemia was found to be present in 200 subjects. On haemoglobin electrophoresis, thalassemia minor was diagnosed in 82 having increased level of HbA2 and 118 patients had microcytosis due to other causes. Mean RDW was 16% in the thalassemia minor group compared to 23% in microcytosis due to other causes. However, 48% (39/82) samples with thalassemia minor and 94% (110/118) with other causes of hypochromic microcytic anaemia had elevated RDW. Haemoglobin S/D was present in 5% (15/300) of the cases, whereas 5.8% (16/300) had thalassemia major. Patients with normocytic normochromic anaemia had a mean RDW of 16.8% and macrocytic anaemia was present in only 2 cases (Table I).

Table I. Frequency of different types of Anaemia with RDW Values.

Classification	No.	(%)	RDW (%) Mean	Range	Elevated RDW No.	(%)
Thalassemia minor	82	(27)	16	12.4-21.9	39/82	(48)
Microcytosis other than thalassemia	118	(39)	23	14.4-32.3	110/118	(94)
Normochromic normocytic anaemia	60	(20)	16.8	-	-	
Thalassemia major	16	(5)	-	-	-	
Hb S/D	15	(5)	-	-	-	
Others	9	(3)	-	-	-	
Total	300	(100)				

Mean, range and percentage distribution of increased RBC (x 1012/1) count in microcytosis are presented in Table II.

Table II. Mean, Range and Percentage Distribution of increased RBC Count in Microcytosis.

Classification	RBC count (x 10^{12}/1) Mean	Range	Increased RBC count No.	(%)	Mean MCV (fl)
Thalassemia trait (No.82)	5.5	3.3-7.2	68	(83)	63.0
Microcytosis due to other causes (No.118)	4.0	1.19-5.9	2	(1.7)	64.5

Erythrocytosis was more common in thalassemia minor with a mean RBC count of 5.5 (x 1012/1), while patients with hypochromic anaemia had a mean RBC count of 4.0 (x 1012/1). Red cell count was elevated in 83% (68/82) cases of the thalassemia minor and 1.7% cases with other causes of microcytic anaemia. The mean MCV differed very little, being 63 fi versus 64.5 fi between thalassemia minor and microcytic anaemia respectively. DF was negative in 61% cases of thalassemia minor and none with microcytic anaemia. Relationship between haemoglobin and RDW values, among the thalassemia patients are presented in Table III.

Table III. Normal and Abnormal Haemoglobin (Hb) levels and RDW in Patients with Thalassemia Trait.

Hb	RDW Normal No. (%)	RDW Elevated No. (%)	Total No.
*Normal	22 (79)	6 (21)	28
Low	19 (35)	35 (65)	54
Total	41	41	82

*Normal Hb: ≥ 11 gm/dl.

Of the 28 thalassemic patients with normal haemoglobin level, 22 (79%) had normal RDW and 54 of those with low haemoglobin level, 35 (65%) had elevated RDW. The mean haemoglobin level of the thalassemic patients was 11.3 g/dl, 28 cases of this group had normal haemoglobin level. The mean haemoglobin level of the patients with microcytic anaemia due to other causes was 7.8g/dl.

Discussion

Bessman et al[2] were able to classify 96% of the anaemias due to thalassemia minor and 97% due to iron deficiency using RDW while Flynn et at[7] reported that elevated RDW in thalassemia and other conditions limits its usefulness in the initial diagnostic classification of microcytic anaemias, as has also been observed in this study. Mean RDW in thalassemia was lower (16%) compared to those with microcyrtosis (23%) due to other causes. However, about 48% of the patients with thalassemia minor had elevated RDW (Table I). The thalassemic patients had a higher mean of 5.5 (x 10^{12}/1) erythrocyte count compared to the mean of 4.0 (x 10^{12}/1) obtained for ,cases with microcytosis due to other causes (Table II). Discriminate function (DF) was also found to be less useful in defining the cause of microcytic anaemia, with 60% cases of thalassemia having negative DR Normal RDW was obtained in

79% of the patients with thalassemia who had normal haemoglobin level and 69% had elevated level in the same group of patientsbut having lower haemoglobin level (Table III). It couldbe because the thalassemic patients who had low haemoglobin might have had a concomitant iron deficiency causing a rise in RDW. Thus RDW should not be used alone as a reliable indicator to distinguish between thalassemia minor and microcytosis due to other causes. It seems that at present further studies should be done to define the cause of microcytosis and confirm a diagnosis. However in retrospect, a patient with normal RDW, erythrocytosis and a negative DF value can confidently be diagnosed as thalassemia minor.

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