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Original Article

Red Cell Indices In Beta Thalassaemia Trait In Adult

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Abstract:

Hypochromic & microcytic blood picture is one of the commonest abnormalities that a clinician come across in Bangladesh. A vast majority of such cases have iron deficiency. In Bangladesh about 3% of total population with a hypochromic and microcytic blood picture is beta thalassaemia trait. In areas where thalassaemia is common, differentiation between iron deficiency anaemia and the carriers of beta thalassaemia trait becomes problem. The uncomplicated beta thalassaemia trait usually have normal iron stores. Though they have microcytic hypocromic blood picture but they are resistant to iron therapy. With the presumption of iron deficiency, supplementation of iron to that cases produce iron overload and may produce organ dysfunction. So it is very important to distinguish between these two entities. Apart from estimation of Hb-A2, iron deficiency and beta thalassaemia trait can be differentiated on the basis of red cell count and red cell indices like MCV, MCH & MCHC. In this study 50 confirmed cases of beta thalassaemia trait aged 18 to 60 years of both male & female were included as cases & 50 cases of age & sex matched iron deficiency subjects were included as controls. RBC count, MCV, MCH & MCHC were measured by an electronic cell counter device. The present study revealed that RBC counts were higher in beta thalassaemia trait than in iron deficiency subjects and MCV, MCH & MCHC were significantly lower in iron deficiency subjects than in beta thalassaemia trait.

Key words: Beta Thalassaemia Trait, Red cell indices.

Introduction:

Microcytic hypochromic anaemia is one of the commonest hematological abnormalities in Bangladeshi population. And microcytic hypocromic blood picture is one of the commonest finding encountered during peripheral blood film examination. It is an important clue as it helps to differentiate anaemia to four well defined conditions.These are iron deficiency anaemia, beta thalassaemia trait, anaemia of chronic disorders and sideroblastic anaemia.The pattern of red cell indices in iron deficiency and thalassaemia minor has important clinical implications in haematology and medicine[1].

Beta thalassaemia is the most common single gene disorder causing a major genetic health problem in the world[2]. It occurs widely in a broad belt, ranging from the Mediterranean & parts of North & West Africa through the Middle East & Indian subcontinent to South East Asia[3].It is estimated that 1.5% of the world population is beta thalasaemia trait,about 60,000 new carriers are born each year and 50% of world thalassemia minor are in South east asia[4]. Bangladesh lies in the thalassaemia belt and beta thalassaemia is common here. About 3% of total population that is about 3.6 million people of our country has beta thalassaemia trait[5]. The heterozygous

state for beta thalassaemia is not usually associated with any clinical disability, and the abnormality is discovered only on performing a blood examination. It is most commonly discovered during periods of stress, such as pregnancy or during severe infections, when a moderate degree of anaemia may be found[6]. Effective population screening for thalasaemia trait can dramiatically decrease the incidence of thalassemia major births,for which peripheral smear examination is an invaluable along with red cell indices[7].

Red cell indices play an important role in the diagnosis of anaemias especially microcytic hypocromic and macrocytic anaemias. As early as 1934, wintrobe presented a scheme for classifying anaemias morphologically, based on indices calculated from manually determined red cell parameters. Red cell indices include mean corpuscular volume(MCV), mean corpuscular haemoglobin (MCH), mean corpuscular haemoglobin concentration mean (MCHC).The MCV indicates whether the average erythrocyte is normocytic, macrocytic or microcytic. The MCH indicates the average weight of haemoglobin per erythrocyte. The MCHC determines whether erythrocyte are normochromic, hypochromic or hyperchromic.Indices are also helpful in quality control[1].

The subjects of beta thalassaemia trait usually have normal iron stores[8]. Though they have microcytic hypocromic blood picture but they are resistant to iron therapy. With the presumption of iron deficiency, supplementation of iron to that cases produce iron overload and may produce organ dysfunction[9].So it is mandatory to differentiate between iron deficiency anaemia and beta thalassaemia trait.Apart from estimation of Hb-A2, iron deficiency and beta thalassaemia trait can be differentiated on the basis of red cell count and other red cell indices like MCV, MCH & MCHC. Estimation of Hb-A2 by hemoglobin electrophoresis is an important tool to diagnosis beta thalassaemia trait. Where this facility is unavailable preliminary microscopic examination of hypochromic & microcytic anaemia cases & subsequent measurement of the red cell indices may be a guide to perform hemoglobin electrophoresis. So this study was designed to see the red cell indices in 50 confirmed cases of beta thalassaemia trait & in 50 cases of iron deficiency anaemia to see the difference between the two groups & to suggest that RBC count & red cell indices like MCV, MCH & MCHC may be valuable tools for the diagnosis of beta thalassaemia trait.

Materials & Methods:

This cross sectional study carried out in the department of Biochemistry and department of haematology, Dhaka Medical College in collaboration with Dhaka Shishu Hospital Thalassaemia Center (DHTC) and Pathology Department of Dhaka Shishu Hospital, Sher-e-Bangla Nagar, Dhaka from July 2009 to June 2010.

Study population was the confirmed 50 cases of beta thalassaemia trait, aged 18 to 60 years of both male and female. This study population included the parents of known cases of beta thalassaemia major children who attended in Dhaka Shishu Hospital Thalassaemia Center (DHTC) for blood transfusion or iron chelation of their children. 50 cases of age & sex matched iron deficiency subjects were included as controls.

5 ml of blood was collected from both case and controls under full aseptic precaution. Estimation of MCV, MCH, MCHC and RBC count were done by electronic cell counter devises HYCEL, Diagnostics (France). Cases of beta thalassaemia trait were confirmed by haemoglobin A_2 estimation by HYDRAGEL-MINI (E) Haemoglobin electrophoresis.

Blood samples were also collected for estimation of serum ferritin level to confirm iron deficiency anaemia from beta thalassaemia trait. The diagnosis of beta thalassaemia trait was made on the basis of low MCV, MCH & increasing Hb-A_2 level (> 3.5%) on haemoglobin electrophoresis. All the control subjects were investigated for the percentage of Hb-A_2 to exclude the possibility of beta thalassaemia trait. Hb-A_2 level of less than 3.5%, provided with low MCV and MCH were considered as subjects of iron deficiency anaemia.

Data were entered in the IBM PC and SPSS software (version 14) was used to analyze the data. Values of the different parameters compared to see the difference between two groups by using student's t-test. $p<0.05$ was considered as significant and $p>0.05$ was taken as non significant. 95% confidence limit was taken as the level of significance.

Results :

Table: I

RBC Count (10^{12}/l) in study subjects

Groups	RBC Count (10^{12}/l)		*t*	P value
	Mean	SD		
Case	5.8	1.86	3.599	0.001
Control	4.8	0.69		

Table: I shows RBC count (10^{12}/l) in both case and control groups. The mean RBC count was (5.8 ± 1.86)×10^{12}/l in case group and (4.8 ± o.69)×10^{12}/l was in control group. A statistically significant mean difference was found, indicating case group had higher RBC count than control group

Table: II
MCV(fl) in study subjects

Groups	MCV (fl)		*t*	P value
	Mean	SD		
Case	68.62	4. 92	-5.85	0.001
Control	60.12	3.25		

Table: II shows the mean level of MCV (fl) was (68.62 ± 4.92) in case group. The mean level of MCV (fl) was (60.12 ± 3.25) in control group. A statistically significant mean difference was found, indicating case group had higher MCV than control group.

Table: III
MCH(pg) in study subjects

Groups	MCH (pg)		*t*	P value
	Mean	SD		
Case	20.34	1. 46	-6.13	0.001
Control	18.50	2.41		

Table: III shows the mean level of MCH (pg) was (20.34 ± 1.46) in case group. The mean level of MCH (pg) was (18.50 ± 2.41) in control group. A statistically significant mean difference was found, indicating case group had higher MCH (pg) than control group.

Table: IV
MCHC (gm/dl) in study subjects

Groups	MCHC (gm/dl)		*t*	P value
	Mean	SD		
Case	29.74	1. 70	-5.45	0.001
Control	26.16	1.60		

Table: IV shows the mean level of MCHC (g/dl) was (29.74 ± 1.70) in case group. The mean level of MCHC (g/dl) was (26.16 ± 1.60) in control group. A statistically significant mean difference was found, indicating case group had higher MCHC (g/dl) than control group.

Discussion :

Iron deficiency anaemia is the most common single nutritional disorders in humans in both developing and developed countries[10]. Both iron deficiency anaemia and beta thalassaemia trait are the most frequent causes of microcytic hypochromic anaemia[11].

In last four decades many formulae have been proposed to discreminate between the two common cause of microcytic hypochromic anaemia. These formulae based on Hb, RBC count, MCV and RDW, are useful in uncomplicated cases but not in patients who have both iron deficiency anaemia and beta thalassaemia trait, a situation not uncommon in Indian subcontinent[12]. The accepted protocol for diagnosis of iron deficiency anaemia and beta thalassaemia trait in routine haematology laboratories is the performances of complete blood count (CBC),serum iron profile, Haemoglobin electrophoresis and Hb A2 quantification[7].

In beta thalassaemia trait, MCV and MCH are reduced, with values of 63-77 fl and 18-25 pg respectively. The MCHC is usually marginally reduced or normal[13]. In the present study, the mean level of MCV (fl), MCH (pg), MCHC (g/dl) was (68.62 ± 4.92), (20.34 ± 1.46), (29.74 ± 1.70) respectively in case group. The mean level of MCV (fl), MCH (pg), MCHC (g/dl) was (60.12 ± 3.25, (18.50 ± 2.41), (26.16 ± 1.60) respectively in control group. A statistically significant mean difference was found, indicating beta thalassaemia trait had higher MCV, MCH, MCHC level than iron deficiency anaemia . Similar results were obtained by Hinchliffe et al.[14] ; Rahman MS[15] ; Selimuzzaman et al.[5] They found that MCV and MCH level were significantly higher in beta thalassaemia trait than iron deficiency anaemia. This results does not correlates with the results of Rahman MM et al[16]. study. But Weatherall[6] stated that MCH values of beta thalassaemia trait were 20 to 22 pg and MCV values of 50 to 70 fl. In one study of 45 cases by Pearson HA, the MCV was 64.70 ± 4.4 fl (mean ± 1 SD), the MCH was 20.30 ± 2.2 pg and the MCHC was 31.20 ± 1.0 g/dl [17]. All these results are consistent with the results of present study.

According to Demir, RBC count and RDWI are the most reliable discrimination indices in differentiation between beta thalassaemia trait and iron deficiency anaemia [18].In a study by Bessman and Feinstein[19], the mean number of RBC count was normal in beta thalassaemia trait. This result does not agree with the result of the present study. The present study showed that the mean level of RBC count was (5.8 ± 1.86)×10^{12}/l in case group and (4.8 ± o.69)×10^{12}/l was in control group. A statistically significant mean difference was found between these groups indicating beta thalassaemia trait had higher RBC count than iron deficiency anaemia . The finding of this study regarding RBC count agrees with the study of Isaacs, Altman and Valman[20], they found that beta thalassaemia trait had significantly higher numbers of red cells.

Conclusion :

The results of the study demonstrate that by measuring the RBC count, MCV, MCH & MCHC in microcytic hypochromic anaemic patients, physicians can get impression about beta thalassaemia trait which is common in Bangladesh. In this situation this disorders should be further confirmed by hemoglobin electrophoresis by estimating the level of Hb-A2. When a microcytic hypochromic anaemic patient visits a physician, the physician should not overlook it as case of iron deficiency anaemia though iron deficiency anaemia is common in Bangladesh. We should remember that all the subjects of beta thalassaemia trait produces microcytic hypochromic blood picture, but all subjects of microcytic hypochromic anaemia are not beta thalassaemia trait. The serum iron level remains normal in adult beta thalassaemia trait although they have microcytic hypochromic RBC. This microcytic hypochromic blood picture is not due to iron deficiency.This is due to inherited impairement of haemoglobin production. This defective production usually results from disabling point mutation causing absent or reduced beta chain production. So, estimation of serum ferritin level should be done before iron supplementation. Random iron supplementation should be avoided by observing microcytic hypochromic blood picture. Unless iron deficiency coincides with beta thalassaemia trait, iron supplementation may not be of benefit in the management and long term usage produce the complications of iron overload. The outcome of the study suggests that measurement of red cell indices is an important tool to guide the physicians to exclude the beta thalassaemia & help them to give iron supplementation in really deserving cases.

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