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STUDY TO DETERMINE THE PRESENCE OF IRON DEFICIENCY ANEMIA AND BETA THALASSEMIA TRAIT SIMULTANEOUSLY

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Abstract:

Introduction: *The feature of beta-thalassemia (β-TT) is common in this subcontinent as well as in Pakistan. 3% of our total population has been documented to have β-TT. Iron deficiency anemia (IDA) remains one of the most serious and important eating disorders in the world, especially in Pakistan. Microcytic hypochromic blood pictures are a common symptom of both disorders. The purpose of this study was to see if the two could coexist.*

Methods: *This was a cross-sectional study conducted at the Department of Internal Medicine of Mayo Hospital Lahore for one-year duration from July 2019 to July 2020. A total of 54 participants were selected from the Medicine department. All of them had β-TT confirmed by capillary hemoglobin electrophoresis. Appropriate advice was given and informed consent was given. Relevant history was collected and a study was conducted. 5 ml of venous blood was collected and sent to the Biochemistry department to measure iron, ferritin, and serum iron binding capacity (TIBC). The transferrin saturation (T.Sat) was calculated from the formula (iron / TIBC) X100.*

Results: *Finally, 54 patients who met the recruitment criteria were analyzed. Among them, 85% (46) of patients were women and 15% (8) were men. The median age was 30 years (range 11-80 years). Most of the 78% (42) patients belong to the 15 to 44 age group. Mean (± SD) HbA2 (%) was 5.35 (± 1.39), Hb (%) 9.04 ± (1.39), MCV (fl) - 67.02 (± 10.39), MCH (pg) - 21.06 (± 3.99), WFD (%) - 17.77 (± 3.85). Among them, 44.4% (24) had low iron levels (<40 µg / dl), 29.6% (16) had low ferritin (15 µgm / l), 33.3% (18) had high TIBC (> 407 µg / dl), and 50% (27) had low transferrin saturation (<16%). Iron deficiency was found in 13% (7) of patients across all parameters, and 63% (34) of patients were iron deficient in at least one parameter.*

Conclusions: *In this study, the frequent occurrence of iron deficiency (29.6%) in people with β-TT, which is a potentially correctable clinical condition, was demonstrated. Iron levels among β-TT should be properly assessed, and people with iron deficiency should be treated promptly, which may improve their overall well-being.*

Key words: *feature of β-thalassemia, iron deficiency anemia.*

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INTRODUCTION:

Thalassemia syndrome is a heterogeneous group of genetic blood disorders associated with hemoglobin synthesis, all of which result from decreased production rates of one or more hemoglobin globin chains[1-2]. Several types of thalassemia according to the globin chain involved have been described, of which the most common clinically relevant types are α and β thalassemia. Pakistan lies in the thalassemia belt, but there are no definitive data on hemoglobin carrier status[3-4]. The World Health report estimates that 3% of all our populations are carriers of β-thalassemia. The beta thalassemia trait (β-TT) is a carrier state in which only one allele is silenced. The person suffers from microcytic hypochromic anemia. Detection typically includes low MCV (<80 fL), low MCH (<27 pg), and an increase in hemoglobin A2 fraction (> 3.5%)[3-4]. It is believed that β-TT offers advantages in positive iron balance. However, in recent years, observers have pointed out that β-TT may be associated with iron deficiency through certain explanatory conditions. Because the symptom of iron deficiency resembles any anemia and the blood picture is similar to thalassemia[5]. At the same time, the occurrence of iron deficiency in these people is neglected. It has a more harmful effect on the body than β-TT. Risks of iron deficiency include impaired cognition, behavior and physical growth, decreased immune status, decreased work performance, increased perinatal risk of maternal and infant mortality, and impairment of endocrine function. Iron deficiency is the most common and widespread nutritional disorder in the world. That's about half of all anemia cases in the world, and the true number is probably over a billion, it affects women more than men. Anemia is especially pronounced in South Asia[6-7]. For example, in Pakistan, up to 88% of pregnant women and 74% of non-pregnant women are affected by the disease. So far, no country-wide survey for anemia has been conducted in Pakistan. However, Pakistan's first national nutritional study in 2010 revealed that about a third of the total population was anemic. In the second and third nutritional studies in 2013 and 2015, the prevalence of anemia among the rural population was 70%, respectively. A recent 2017 study revealed that the overall prevalence of anemia was 74%, compared to 63.7% in cities and 77.1% in rural areas. A study found that nearly 50% of pregnant women in rural Pakistan were anemic. In 2004, the Institute of Public Health Nutrition found that 40% of adolescent girls and 31% of adolescent boys, as well as 46% of non-pregnant women and 39% of pregnant women, suffered from anemia[4-6]. In a recent (2011) study by Kumar et al. Found that 55.3% of students were anemic, of which 36.7% were male and 63.3% female among university students (17-25) in the Pakistan[7-8]. Iron deficiency is responsible for approximately 50% of all anemia. It has been classified as one of the top 10 health problems by the World Health Organization (WHO) .5,6 Iron deficiency associated with people with β-TT requires special attention. If such people are properly identified and treated with iron, their anemia will improve; thus, improve overall well-being[9-10].

METHODS:

This cross-sectional study was conducted at the Department of Internal Medicine, Mayo Hospital Lahore for one-year duration from July 2019 to July 2020. People with β-TT who came for follow-up visits or referrals from another doctor / institute or were identified were identified. Adequate advice was given to them to include this study. Participants who had been treated with iron or H / O receiving iron therapy within the last month and a history suggesting any underlying inflammatory or malignant disease that may affect serum ferritin levels were excluded. The advantages and disadvantages of this study were provided and explained to them. If they gave their consent and gave informed consent, an appropriate physical examination was performed and 5 cm3 of blood was collected for CBC and iron profile. β-TT was diagnosed on the basis of elevated HbA2 (> 3.5 gm / l) using the Helena Bioscience V8 method (capillary electrophoresis method). Complete hemogram using an automated cell analyzer, serum ferritin using an automated analyzer, serum iron and TIBC using an automated analyzer (Architect plus ci4100), transferrin saturation was calculated by the formula [(iron / TIBC) x100]. After collecting the laboratory data, appropriate analysis was performed and conclusions were drawn regarding the iron level of the β-TT participant. All data was processed with SPSS (version 22) and expressed as frequencies or percentages as well as mean (± SD) if applicable.

RESULTS:

Of the 54 participants, 8 (14.8%) were men and 46 (85.2%) were women. The median age was 30 years (range 11-80 years). Most of the participants (78%) were aged 15–44. The male to female ratio was 1: 5.75. The basic hemogram of the study population is given in Table I. Of 54 participants, 48 (88%) had nonspecific symptoms, among which 42 (77%) had fatigue, 38 (70%) lethargy, 30 (55%) palpitations, 22 (40%)) had shortness of breath. In physical examination, 24 (44%) had tachycardia, 12 (22%) koilonychias, 9 (16.6%) had angular stomatitis, 6 (11%) glossitis, 4 (7.4%) had ankle swelling, and 2

(3.7%) had splenomegaly. Of the 54 participants, 24 (44.4%) were deficient in serum iron, 16 (29.6%) had low serum ferritin, 18 (33.3%) had high TIBC, 27 (50%) had low T. Sat. (Table II). In addition, 6 (11%) participants had serum ferritin levels of 15-30 (µgm / L). These participants may have latent iron deficiency. On the other hand, 9 (16.7%) had higher than normal serum ferritin levels (> 300 µgm / L).

Table-I

Heamogram of the study participants (n=54)

Variables	Mean (±SD)	Range	Median	Mode
HbA2 (gm/dl)	5.35 (±1.39)	3.60-9.77	5.08	5.10
Hb (gm/dl)	9.04 (±1.34)	6.0-11.7	9.40	9.80
MCV (fl)	67.02 (±10.39)	52.0-95.8	63.70	62.0
MCH (pg)	21.06 (±3.99)	14.30-31.40	20.0	20.0
RDW (%)	17.77 (±3.85)	10-30.95	17.0	16.0

Table-II

Iron profile of the study participants (n=54)

Variables	Mean (±SD)	Range	Median	Mode	IDA	
					No	%
S. Iron (µg/dl)	66.99 (±54.98)	3.47-257.0	50.0	34.0	24	44.4
S. Ferritin (µg/dl)	205.6	1.10-2108.0	46.05	52.35	16	29.6
TIBC (µg/dl)	349.89 (±122.98)	53.40-677	348.5	435	18	33.3
T. Sat (%)	23.82	1.92-172.0	16.76	5.80	27	50

These β-TT participants (16) had low serum ferritin (<15 µgm / l), of which 10 (62.5%) had low serum iron (<40 µg / dl), 9 (56.25 %) had high TIBC (> 407 µg / dL) and 12 (75%) had low T Sat (<16%). IDA β-TT had significantly lower statistically significant concentrations of iron, ferritin, serum transferrin saturation, and higher TIBC than non-IDA β-TT. (Table III)

Table-III

Comparison of β-TT with IDA vs. β-TT with non IDA (n=54)

Parameters	IDA (16) Mean±SD	Non-IDA (38) Mean±SD	P value
HbA2	4.91±1.26	5.53±1.42	0.138^{NS}
Hb (gm/dl)	8.61±1.66	9.56±1.14	0.020^{S}
MCV (fl)	62.14±5.98	69.08±11.20	0.024^{S}
MCH (pg)	19.08±3.78	21.89±3.83	0.017^{S}
RDW (%)	18.53±3.21	17.45±4.09	0.356^{NS}
S. iron (µg/dl)	40.65±35.95	78.08±58.13	0.021^{S}
TIBC (µg/dl)	437.69±90.84	312.93±116.55	$<0.001^{S}$
S. ferritin (µgm/L)*	6.69 (1.10-14.0) **	92.79 (15.22-2108.0) **	$<0.001^{S}$
TSAT (%)*	5.25 (1.92-32.60) **	25.61 (3.50-172.0) **	$<0.001^{S}$

DISCUSSION:

In this small study, we found that approximately 30% of participants had comorbid iron deficiency out of 54 confirmed β-TT participants. Furthermore, we found that 11% of the participants had latent iron deficiency (serum ferritin 15-30 µgm / L). In 1987

Economidou et al. found in their studies that iron deficiency was a common symptom in women of childbearing age who did not receive iron supplementation[9-11]. Iron status in β-TT has been of interest to many authors due to the frequent iron overload in severe thalassemia. The relative high frequency of iron deficiency in our β-TT participants (30%) was confirmed by the results of other researchers. In 2017, Mujahida et al. their study documented that 30.2% of thalassemia traits had IDA. Similar results were also documented in subsequent studies from 2012 by Dolai TK et al. And in 2014 by Das R et al., The incidence of IDA in people with β-TT was 19.3% and 20.7%, respectively. As the trial participants were mainly (78%) women of childbearing age (15-44 years), iron deficiency is also common in this age group. This view is consistent with the results of other studies published in the recent past[12-13]. The results of this study also suggest that iron deficiency is a fairly common comorbid condition in β-TT. Regarding Pakistan, coexistence may be due to poverty, gastrointestinal blood loss, worm infestation, low bioavailability and low iron content in food. Of course, excessive menstruation, pregnancy and breastfeeding also play an important role in IDA in the reproductive age of women. Earlier literature suggested a protective effect on IDA in people with β-TT and warned against iron overload due to unnecessary supplementation. However, recently published Indian data documented a high incidence of IDA, ranging from 20% to 30% among patients with β-TT[14]. Therefore, studying the iron profile is of great importance in this subgroup of patients. In addition, it is common practice that a patient with thalassemia should not take foods or medications containing iron or iron, which deprives them of iron supplementation, especially in those with iron deficiency. On the other hand, patients with β-TT should be cautioned that their blood picture resembles iron deficiency and that they may be misdiagnosed. They should beware of the empirical use of iron; however, iron deficiency may develop. In this study, we also found that approximately 17% of participants had higher than normal serum ferritin (> 300 µgm / L). These participants may have iron overload. This iron overload may be due to low hemolysis or unwise iron therapy or hemochromatosis. In 1985, Fargion S et al. Found in their studies that 50% of iron-loaded β-TT had idiopathic haemochromatosis. Finally, the authors suggest that individuals with β-TT anemia with low MCV and MCH may have comorbid iron deficiency, therefore the iron profile should be checked routinely and if iron deficiency is coexisting, appropriate treatment[14-15].

CONCLUSIONS:

About 30% of study participants had IDA (serum ferritin <15 µgm / L). Another 11% had a latent IDA. The study also documented that β-TT had significant low levels of Hb (gm / dl), MCV (fl), MCH (pg), serum iron (µg / dl), ferritin (µgm / l) and T. sat with IDA than β-TT without IDA. Thus, the results of this study suggest that iron deficiency may coexist with β-TT. Due to the high prevalence of IDA in Pakistan, an anemic person with β-TT should have their iron profile assessed and treated appropriately.

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