J Medicine 2018; 19: 44-48

Co-existence of Iron Deficiency in Beta Thalassaemia Trait

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Abstract

Background: *Beta-Thalassaemia Trait (β-TT) is common in this subcontinent as well as Bangladesh. 3% of our total population is documented to have β-TT. Iron deficiency anemia (IDA), remains one of the most severe and important nutritional disorder in the world especially in Bangladesh. Microcytic hypochromic blood picture is common manifestation of both disorders. Purpose of the present study was to see whether both can co-exist.*

Methods: *This was a cross sectional study carried out in Department of Internal Medicine, Bangabandu Sheikh Mujib Medical University (BSMMU), Dhaka from January-2014 to August-2015. Total 54 participants were selected from Haematology outpatient department (OPD), BSMMU. All of them had β-TT confirmed by Capillary Haemoglobin Electrophoresis. Proper counseling was done and informed consent was taken. Relevant history was taken and examination was done. Five ml of venous blood was collected and sent to Biochemistry department to measure serum iron, ferritin and tissue iron binding capacity (TIBC). Transferrin saturation (T.Sat) was calculated by formula (iron/TIBC) X100.*

Results: *Total 54 patients who fulfilled the recruitment criteria were finally analyzed. Among them 85% (46) patients were females and 15% (8) were males. Median age was 30 years (range11-80 yrs). Most of the patients 78 % (42) belong to the age group between 15 to 44 years. 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), RDW (%)- 17.77 (±3.85). Among them 44.4% (24) had low iron (<40μg/dl), 29.6 % (16) had low ferritin (15μgm/L), 33.3% (18) had high TIBC (>407μg/dl), and 50% (27) had low transferrin saturation (<16%). 13% (7) patients were found to be iron deficiency considering all parameters and 63% (34) patients were iron deficient in at least one parameter.*

Conclusions: *The present study shows the frequent occurrence of iron deficiency (29.6%) in subjects with β-TT which is a potentially correctable clinical condition. Proper assessment of iron level among the β-TT should be done and those who are iron deficient, should be treated promptly which may improve their general wellbeing.*

Keywords: *β-Thalassaemia trait, Iron deficiency anaemia.*

Introduction:

The thalassemia syndrome are heterogenous group of genetic blood disorders of haemoglobin synthesis, all of which result from reduced rate of production of one or more of globin chain of haemoglobin. Several types of thalassaemia have been described and according to affected globin chain, the most common types of clinical important being α and β thalassaemia.

Bangladesh lies in thalassaemia belt but it has no definitive data regarding carrier stat of haemoglobin disorder. A conservative World Health report estimates that 3% of our total populations are of β-thalassaemia carrier.[1] Beta thalassemia Trait (β-TT) is a carrier state in which only one allele is muted. Individual will suffer from microcytic hypochromic anaemia. Detection usually involves low MCV (<80 fL), Low MCH (<27 pg) and increase fraction of Haemoglobin A2 (>3.5%).[2]

It is believed that β-TT confers advantage in iron positive balance. But in the recent years observers pointed out that β -TT can be associated with iron deficiency by some explanatory conditions. Because the sign of iron deficiency resembles as that of any anaemia and the blood picture as

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like as thalassemia. Simultaneously prevalence of iron deficiency in these people is overlooked. It has more deleterious effect in the body than β-TT. The hazards of iron deficiency includes impair the cognitive performance, behaviors and physical growth, reduced immune status, decrease work performance, increase perinatal risk of mother and infant mortality and impaired endocrine function.[3]

Iron deficiency is the most common and widespread nutritional disorder in the world. It is approximately half of all anaemia cases worldwide, and true number probably exceeds one billion, affects woman more often than men.[4] Anaemia is particularly prominent in South Asia. In India for example up to 88% of pregnant and 74% of non-pregnant women are affected.[3]

Until now there has not been a national survey of anaemia in Bangladesh. However the first national nutritional survey of Bangladesh in 1962/64 (when country was known as East Pakistan) revealed that about a third of total population had anaemia. The second and third nutritional surveys in 1975/76 and 1981/82, respectively, reported a prevalence of 70% for anaemia among the rural population. The most recent survey in 1995/96 revealed that the overall prevalence of anaemia was 74%, being 63.7% for the urban and 77.1% for the rural population. The national vitamin A survey conducted in 1997-98 showed that nearly 50% of the pregnant women in rural Bangladesh had anaemia. In 2004, Nutritional Surveillance project of Helen Keller International in collaboration with the Institute of Public Health Nutrition showed 40% of adolescent girl and 31% of adolescent boys as well as 46% non-pregnant and 39% pregnant women were affected by anaemia.[5]

In a recent (2011) study by Kumar et al. found that 55.3% students were anaemic, of whom 36.7% were male and 63.3% were female among the University students (17-25) in Noakhali region of Bangladesh.[6]

Iron deficiency is responsible for approximately 50% of all anaemia.[6] It is categorized as one of the 10 most serious health problem by World Health Organization (WHO).[5,6] Iron deficiency associated with β-TT subjects require careful attention. If such subjects are properly identified and treated with iron, their anemia will improve; hence improve general wellbeing.

Methods:

This cross sectional study was carried out in Hematology OPD, BSMMU, Dhaka from January, 2014 to August, 2015. β-TT individual those who used to come for follow up or referral from other physician/institute or newly diagnosed were identified. Proper counseling was done them to include this study. Participants those were on iron therapy or H/O receiving iron therapy within last one month and history suggestive of concurrent any inflammatory or malignant disease which may affect serum ferritin were excluded.

Assurance and explanation was made them regarding merits and demerits of this study. If they were agreed and gave informed consent then relevant physical examination was done and 5 cc blood was collected for CBC and Iron profile.

β-TT was diagnosed by raised HbA2 (>3.5gm/L) by Helena Bioscience V8 (Capillary Electrophoresis Method). Complete haemogram by automated cell analyzer (Pentra ABX-120 DX and Sysmex XT-2000i), Serum ferritin by automated analyzer (Architect plus ci4100), Serum iron & TIBC by automated analyzer (Architect plus ci4100), Transferrin Saturation was calculated by formula [(iron/TIBC) x100]. After collection of laboratory data it was properly analyzed and conclusion was made regarding iron status of β-TT participant. All data were processed by utilizing SPSS program (Version 22) and expressed as frequencies or percentages as well as mean (±SD) as applicable,

Results:

Out of 54 participants 8 (14.8%) were male and 46 (85.2%) were female. Median age was 30 years (range11-80 yrs). Most of the participants (78%) were within 15-44 years. Male female ratio was 1:5.75. Basic Hemogram of study population was given in table I. Among 54 participants 48 (88%) had nonspecific symptoms these include 42 (77%) had tiredness, 38 (70%) had lethargy, 30 (55%) had palpitation, 22 (40%) had shortness of breath. On physical examination 24 (44%) had tachycardia, 12 (22%) had koilonychias, 9 (16.6%) had angular stomatitis, 6 (11%) glossitis, 4 (7.4%) had ankle oedema and 2 (3.7%) had splenomegaly. Out of 54 participants 24 (44.4%) were serum iron deficient, 16 (29.6%) had low serum ferritin, 18 (33.3%) had high TIBC, 27 (50%) had low T. Sat. (Table-II).

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

In addition 6 (11%) participants had serum ferritin 15-30 (µgm/L). These participants might have latent iron deficiency. On the other hand 9 (16.7%) had higher than normal serum ferritin level (>300 µgm/L). Those β-TT participants (16) had low serum ferritin (<15 µgm/L), among them 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%). β-TT with IDA had much lower statistically significant serum iron, ferritin, transferrin saturation and higher TIBC than that of β-TT with non-IDA. (Table III)

Discussion:

In this small study we found about 30% participants had concomitant iron deficiency among 54 confirm β-TT participants. In addition we also found 11% participants had latent iron deficiency (serum ferritin 15-30µgm/L).

In 1987 Economidou et al. found in their study that iron deficiency was a common finding in female of reproductive age not receiving iron supplementation.[7] Iron status in β-TT has been area of interest for many authors due to the frequent iron over load in thalassaemia major.[8]

Relative high frequency of iron deficiency in our β-TT participants (30%) has been corroborated with the results of other investigators. In the year 2007 Mujahida, et al. in their study documented that 30.2% of thalassaemia traits had IDA.[9] Similar results were also documented in subsequent studies, in the year 2012 by Dolai TK et al.[2] and in the year 2014 by Das R et al.[10], reported prevalence of IDA in β-TT subjects were 19.3% and 20.7% respectively.

As the sample participants were mostly (78%) female of reproductive age (15-44 years), iron deficiency is also common in this age group. This view is in conformity with the results of other studies published in recent past.[2] The findings in this study also suggest that iron deficiency is a fairly common co-existing condition in β -TT.

In respect of Bangladesh co-existence might be due to poverty, gastrointestinal blood loss, helminthes infestation, low bioavailability and low iron content in food. Of course excessive menstruation, pregnancy and breast feeding also play a major role in IDA of female reproductive age.

Previously literatures suggested a protective effect on IDA in person with β-TT and cautioned against iron overloaded due to unnecessary supplementation.[10,11] However recently published Indian data documented high incidence of IDA ranging from

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}

Statistical analysis were done by Unpaired Independent Student t-test between two groups
* Statistical analysis were done by Mann-Whitney-U test
** Median (Range)
n = Number of participants, S = Significant, NS = Not significant

20% to 30% among female patient with β-TT.[2,10-12] So study of iron profile is of paramount importance in this subgroup of patients.

Moreover common practice is that, thalasaemic patient should not take iron or iron containing foods or drugs, which deprived them iron supplementation, those who are especially iron deficient. On the other hand patients with β-TT should be warned that their blood picture resembles iron deficiency and can be misdiagnosed. They should eschew empirical use of iron, yet iron deficiency can develop.

In this study we also found about 17% participants had higher than normal serum ferritin (>300 µgm/L). These participants might have iron overload. These iron overload might be due to low grade heamolysis or injudicious iron therapy or heamochromatosis . In 1985 Fargion S et al. found in their study, 50% of β-TT with iron overload had idiopathic heamochromatosis.[13]

Lastly, the authors suggest that β-TT individuals those who are anaemic with low MCV and MCH might have co-existing iron deficiency, so iron profile should be checked routinely and if iron deficiency co-exists should be treated accordingly.

Conclusions:

About 30% of study participants had IDA (serum ferritin <15 µgm/L). Another 11% had latent IDA. Study also documented that there were significant low Hb (gm/dl), MCV (fl), MCH (pg), serum iron (µg/dl), ferritin (µgm/L) and T.Sat (%) in β-TT with IDA than that of β-TT with non IDA. So the present study findings suggest that iron deficiency may co-exist in β-TT. With the background of high prevailing IDA in Bangladesh, subject having β-TT with anaemia should undergo iron profile assessment and should be treated accordingly.

Conflict of interest: None.

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