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ORIGINAL ARTICLE

Prevalance of Iron Deficiency in Thalassemia Minor: A Study from Tertiary Hospital

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Abstract Conflicting data are available about iron metabolism in thalassemia minors. As iron deficiency prevails largely in India, a study of 150 people was conducted to assess the iron level of β thalassemia minor. The study population comprises of 59 males and 91 female who either attended outdoor services and with diagnosed thalassemia minor by hemoglobin high performance liquid chromatography or were the parents (diagnosed thalassemia minor) of β Thalassemia patients visiting daycare services for transfusion. 29.67% females and 3.38% males are found to be iron deficient. Thus we can conclude that iron deficiency is one of the common co-existing conditions in β thalassemia minors.

Keywords Iron deficiency anaemia · β thalassemia minor · Serum ferritin · HPLC

Introduction

Iron deficiency is a condition resulting from too little iron in the body. Estimates suggest that over one third of the world's population suffers from anemia, mostly iron deficiency anemia (IDA). India continues to be one of the countries with very high prevalence of IDA. National Family Health Survey (NFHS-3) reveals the prevalence of anemia to be 70–80% in children, 70% in pregnant women and 24% in adult men. Prevalence of anemia in India is high because of low dietary intake, poor availability of iron and chronic blood loss due to hook worm infestation and malaria [1].

Among other causes about 85% of people suffering from IDA suffer it as a consequence of deficient iron ingestion or ingestion of an adequate amount of iron but having a low absorption [2]. The terms anemia, iron deficiency, and IDA often are used interchangeably but strictly speaking they are not equivalent. Iron deficiency ranges from depleted iron stores without functional or health impairment to iron deficiency with anemia, which affects the functioning of several organ systems [3]. Iron deficiency is a concern because it can delay normal infant motor function (normal activity and movement) or mental function (normal thinking and processing skills) [3]. Due to increased demand in pregnancy, IDA during pregnancy is very common among those not taking iron supplements and it can increase risk for small or early (preterm) babies. Small or early babies are more likely to have health problems or die in the first year of life than infants who are born full term and are not small. It can cause fatigue that impairs the ability to do physical work in adults. Iron deficiency may also affect memory or other mental function in teens.

The Thalassemia syndromes are inherited disorders of globin synthesis. Thalassemia is a disease with wide spectrum of manifestations ranging from asymptomatic nature to severe disease requiring frequent packed cell transfusion. Thalassemia trait (TT) is a carrier state in which only one allele is mutated. It has been believed that TT confers advantage in iron balance [3–5]. Because the signs of iron deficiency resembles as that of any anemia and the blood picture largely that of TT itself, the simultaneous prevalence of iron deficiency in these people is often overlooked. Iron deficiency does happen in TT patients require careful attention.

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Materials and Method

The objective of our study was to assess the iron status in TT subjects. This is prospective, non interventional, observational study with prospective collection of demographic, clinical, diagnostic and laboratory data. The study was conducted from May 2010 to December 2010 in the department of Hematology, N.R.S. Medical College and hospital, Kolkata. One hundred and fifty people with 59 men and 91 women comprising of patients who attend outdoor services, diagnosed as TT and parents of β Thalassemia major patients visiting daycare services for transfusion were included after detailed informed consent in local language. All subjects underwent detailed clinical evaluation, complete hemogram by automated cell counter (Sysmax KX21), hemoglobin electrophoresis by high performance liquid chromatography (HPLC) Biorad variant, and serum ferritin by ELISA method and if required bone marrow aspiration with iron stain (six patients) and other investigations (serum iron, TIBC, TS) were done to confirm the diagnosis. We did not include any other parameters (like Mentzer Index) in our study.

Hb A2 level 4.0–10.0% along with low MCV (<80 fl), low MCH (<27 pg) are the criteria used for the diagnosis of TT and serum ferritin level ≤15 ng/ml diagnosed as IDA [4]. Patients suffering from fever clinically suspected inflammatory disorders and other haemoglobinopathies were excluded from study. Standard statistical methods (Chi-squared test) were used to analysis the data. SPSS 19 version software was used for data analysis.

Results

Out of 150 subjects, 59 (39.33%) were male and 91 (60.66%) were female. The mean (±SD) age and range was 33.59 ± 0.67 (6–57) years. The mean age (±SD) of male and female were 38.050 ± 0.761 and 30.70 ± 0.61 respectively. The socio economic status (modified Kuppuswamy's scale) are as follows upper (I): 1.33% ($n = 2$), upper middle (II): 2% ($n = 3$), lower middle (III): 14.66% ($n = 22$), upper lower (IV): 80.66% ($n = 121$) and lower (V): 1.33% ($n = 2$). Average weight was 50.65 kg and average weight of male, female was 54.70, 48.03 kg respectively. The presenting symptoms and signs were, general weakness: 29.33% ($n = 44$), pallor: 48% ($n = 72$), icterus: 9.33% ($n = 14$), clubbing: 0.66% ($n = 1$) and edema: 7.33% ($n = 11$). Mild icterus is an incidental finding in our cohort. To find out the exact etiology of icterus others investigations are necessary which is out of scope in our present study. The basic hemogram parameters are as follows [(mean ± SD) (range)]: Hemoglobin (%): 10.94 ± 0.21 (5.2–22.4), MCV (fl): 66.61 ± 1.33 (58.1–77.9), MCH (pg): 20.49 ± 0.40 (14.9–22.9), MCHC (%): 30.78 ± 0.61 (29–33.7) and RDW (%): 16.34 ± 0.32 (13.7–29.5). The mean ± SD and range of HbA2 (%) are 5.362 (4.1–6.5).

Table 1 HbF (%) in this cohort

HbF (%)	No (%) of subjects
<1	117 (78)
1–2	24 (16)
2.1–5	7 (4.66)
>5	2 (1.33)

Table 2 Serum ferritin levels in this cohort

Serum Ferritin	≤15 ng/ml	>15 ng/ml
Total no	29	121
Male no (%)	2 (3.38%)	57 (96.61%)
Female no (%)	27 (29.67%)	64 (70.32%)

The HbF (%) and serum ferritin levels are shown in Tables 1 and 2. Majority of subjects [114 (94%)] had HbF level ≤2 and 6% of subjects had HbF% >2. Elevation of HbF in a beta TT is usually associated with deletion of the 5' part of the beta globin gene or coinheritance of non-deletional hereditary persistence of fetal haemoglobin. Out of 150 subjects 29 (19.33%) had IDA. Comparisons between the subjects with IDA and without IDA are shown in Table 3. Statistical significant differences were found in hemoglobin and MCH level in between the two groups. It was suggested that subjects of beta TT with IDA had lower hemoglobin and MCH level comparing to subjects without IDA. No statistical differences were found in RBC counts between the groups ($P = 0.06$).

Discussion

Iron statuses in TT is always been an area of interest for study. Earlier it was believed that iron deficiency does not exist in TT and so they are different from those suffering from IDA. In 1978 a study "serum Ferritin in beta TT" was conducted to establish serum Ferritin as an important tool to distinguish beta TT from IDA. Because of the very small amounts of serum required for the measurement of ferritin, it was considered particularly suitable for surveying populations with a high prevalence of hypochromic-microcytic anemias [6]. Conflicting data then came up regarding the iron metabolism in TT. In 1987 Economidou et al. [7] presented their study "assessment of iron stores in subjects heterozygous for beta-thalassemia based on serum ferritin levels." which showed that iron deficiency was a common

Table 3 Comparison between the subjects with IDA and without IDA

Parameters	With IDA (SF ≤15)	Without IDA (SF >15)	*t* value	*P* value
Hemoglobin (g/dl)				
Mean ± SD (range)	9.78 ± 0.19 (5.2–11.6)	11.21 ± 0.22 (8.1–22.4)	40.85	<0.01
MCV (fl)				
Mean ± SD (range)	66.24 ± 1.32 (58.1–75.9)	66.70 ± 1.33 (59.5–77.9)	1.68	>0.05
MCH(pg)				
Mean ± SD (range)	20.18 ± 0.4 (14.9–24.4)	20.56 ± 0.41 (17.2–25.8)	4.57	<0.01
RDW (%)				
Mean ± SD (range)	16.34 ± 0.32 (13.7–22.5)	16.4 ± 0.32 (14–20.3)	0.96	>0.05

finding in female TT of reproductive age not receiving iron supplementation.

However in 1987 BC Mehta and BG Pandya examined 124 relatives of children receiving blood transfusion for thalassemia major, both with beta TT and without it (control), and showed that the BTT group had an advantage in maintaining iron balance [4]. A study for the frequency of coincident iron deficiency and beta TT in British Asian children was done in 1995 that showed that the two can co-exist and are mutually exclusive at least in the early years [8]. The evaluation of iron status in Iranian adults in 2000 showed that beta thalassemia minor (BTM) may play a role in improving iron status in females. However in men, BTM can lead to iron overload. They concluded that, iron level should be examined in subjects with the trait especially in men, to avoid harmful effects of iron overload in early stages of the disorder [5]. In the study presented here 150 people with beta TT are examined and of them 29 were found to be iron deficient (19.33%). Thus the exact role of TT in iron metabolism still remains an area to be explored. Nevertheless even the β TT need proper iron care like the people without the trait.

Of the 150 people examined 29 are found to be iron deficient (serum ferritin ≤15). The iron deficiency is more prevalent in the females, 27 out of 91 have SF ≤15 (29.67%) while in males only 2 out of 59 have SF ≤15 (3.38%). High prevalence of IDA in female is possibly due to nutritional as well as excessive menstrual blood loss. Increased ferritin level is not found in any of the subjects. The *P* value of hemoglobin and MCH are <0.01 which is a critical finding and indicates the severe iron deficiency. However, the *P* value of MCV and RDW are >0.05. As the sample population mostly consists of mothers accompanying their children suffering from β thalassemia to the daycare unit of hematology department of NRS Medical College and hospital, the number of females in the study outnumbers the males. Similar study has been conducted in the past showing iron deficiency a common finding in female TT of reproductive age not receiving iron supplementation [7]. The findings here suggest that iron deficiency is a common co-existing condition in beta TT.

Conclusion

The above findings suggest that iron deficiency is one of the co-existing conditions in beta TT. Some even suffer from severe IDA and need prompt treatment. If recognized and promptly treated they have good prognosis. With the background of prevailing IDA in India, the study suggests that proper assessment of iron level even among the beta TT should be done and iron deficiency if detected should be treated promptly.

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