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Study of Clinico-Hematological Profile of Thalassemia at Tertiary Care Centre

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Abstract: ***Background:*** ***Thalassemia is one of the major hemoglobinopathies among the population all around the world. Beta thalassemia major results in severe anemia which needs regular repeated blood transfusion, which leads to iron over load in the body. Iron overload also damages the liver, kidney and other organs secondary to iron deposition. The thalassemia minor syndromes are characterized clinically by mild anemia with persistent microcytosis. Thalassemia intermedia is typified by a moderate, variably compensated hemolytic anemia that may present with clinical symptoms during a period of physiologic stress such as infection, pregnancy, or surgery. So to know the severity of the patient, we retrospectively & prospectively evaluated clinical and hematological parameters of cases of thalassemia.*** ***Methods:*** ***Total 200 subjects were studied. We examined all patients who are clinically and Hematological suspicious of thalassemia and patients diagnosed to have thalassemia based on High Performance Liquid Chromatography (HPLC) over a period of 2 years 3 months. The patients groups were evaluated according to the clinicohematological presentation and HPLC study.*** ***Results:*** ***Pallor was the most common clinical presentation followed by splenomegaly among thalassemia major group. Highest hemoglobin, RBC, MCH, MCHC was found in Sickle Beta Thalassemia i.e. Group C and lowest was found in Group A. Highest MCV (80.83 fl) was found in Beta Thalassemia trait i.e. Group B and lowest MCV (72.01 fl) was found in Beta Thalassemia major i.e. Group A. Average levels of Hb F% in thalassemia major group was 94.44 ± 3.13%. Mean value of serum ferritin in thalassemia major group were found to be significantly increased (4103.21 ± 2786.9 ng/ml).*** ***Conclusion:*** ***High Performance Liquid Chromatography (HPLC) was found to be less labour intensive, rapid and more reliable for quantification of hemoglobin variants. It helps in screening of large population for hemoglobin disorder like thalassemia, sickle cell carrier in premarital and family screening. Most of the clinical findings were dominantly seen with Beta Thalassemia Major. Majority of the cases presented clinically with pallor 80 (53.33%). Other clinical presentation includes- Hepatomegaly 38 (25.33%), Fever 37 (24.67%), Jaundice 33 (22%), Joint Pain 24 (16%) and pain abdomen 1 (0.67%). Serum ferritin levels were found to be significantly increased (4103.21 ± 2786.9 ng/ml) among thalassemia major whereas it is normal in other groups. Beta thalassemia major follows a more severe course and present at younger age compared to other subtypes and is a major public health problem in this area of the country. High cost of treatment, repeated blood transfusion and chelation therapy and economic burden on family resources, all suggest that prevention is better than cure.***

Keywords: Performance Liquid Chromatography (HPLC), Beta Thalassemia major (BTM), Beta Thalassemia trait (BTT), Sickle-Beta Thalassemia, Serum Ferritin

1. Introduction

Thalassemia is one of the major hemoglobinopathies among the population all around the world. It is a single gene hereditary hemoglobin disorder in human. It has been reported that now a day's approximately 1 out of 14 peoples are carrier of different sub types of thalassemia. Each year about 400000 infant born are with serious hemoglobinopathies and carrier frequency is about 270 million.[1]

Inherited Haemoglobin Disorders include structural haemoglobin variants and thalassaemia. Structural haemoglobin variants mostly result from amino acid substitution in either α or βchains. Although over 700 structural haemoglobin variants have been identified, only three [HbS, HbC, HbE] reach high frequencies. Thalassaemia are classified according to the particular globin chains that are ineffectively synthesized into the α, β, δβ, εδβ.[2]

The thalassemias are a group of congenital anemia's that have in common deficient synthesis of one or more of the globin subunits of the normal human hemoglobin's. The primary defect is reduced or absent synthesis of normal globin chains, but there are mutations resulting in structural variants produced at reduced rate and mutations producing hyperunstable hemoglobin variants with a thalassemia phenotype (thalassemic hemoglobinopathies).

In the last few years, the application of recombinant DNA technology has permitted the understanding of the basic aspects of gene structure and function and the characterization of the molecular basis for deficient globin synthesis. The thalassemias result from the effect of a large number of different molecular defects, which may interact, leading to a variety of clinical and hematologic phenotypes.[3, 4]

Haemoglobin fraction analysis by cation-exchange HPLC has the advantage of quantifying HbF and HbA2 along with haemoglobin variant screening in a single, highly reproducible system, making it an excellent technology to screen for haemoglobin variants and hemoglobinopathies along with the thalassemias. The simplicity of the automated system with internal sample preparation, superior resolution, rapid assay time, and accurate quantification of haemoglobin, less sample requirement fractions makes this an ideal methodology for the routine clinical laboratory.[5, 6]

The simplicity of the automated system makes this an ideal methodology for the routine clinical laboratory. Exact diagnosis of these diseases is of paramount importance in therapy and prevention of genetic transmission. This study

was carried out to study clinico-hematological profile of thalassemia.

2. Materials and Methods

The present study is observational prospective and retrospective study in which a total of 200 clinically and haematologically suspected cases of thalassemia during the period of May 2015 to August 2017 were selected.

All the patients (OPD and Indoor) who are clinically and Hematological suspicious of thalassemia. Patients presented with previous history of blood transfusion. All patients diagnosed to have thalassemia based on High Performance Liquid Chromatography (HPLC) along with family members of these patients were taken as inclusion criteria.

After consent was taken, 2 ml of venous blood is collected in EDTA (Ethylene diamine tetra-acetic acid) bulb and 2 ml in two plain bulbs with all aseptic precautions. Complete blood count performed by using Cellenium three part cell coulter and LFT, KFT, serum ferritin were performed by semi automated biochemistry analyzer.

Samples were run on HPLC machine Bio-Rad variant-II and hemoglobin graph was obtained and diagnosis of thalassemia was confirmed using values of different hemoglobin fractions and retention times (Table 1).

Table No 1: Analysate Identification Windows[7]

Retention time (minutes)	Band (minutes)	Window (minutes)	Range
F	1.15	0.15	1.00-1.30
P2	1.45	0.15	1.30-1.60
P3	1.75	0.15	1.60-1.90
A0	2.60	0.40	2.20-3.30
A2	3.83	0.15	3.68-3.98
D-window	4.05	0.15	3.98-4.12
S-window	4.27	0.15	4.12-4.42
C-window	5.03	0.15	4.88-5.18

Maternal/Paternal consanguineous marriage among family members is noted and Family study of cases was carried out wherever possible, to confirm the diagnosis as family study is effective for centers which do not have facility for genetic analysis. Mother, father, siblings, son and daughter of patient were studied.

Clinical findings were correlated with all other investigations. Radiological investigations like USG abdomen, X-skull and X-ray hip joints and other specific investigations were done as and when required.

3. Result

In the present study, total 200 suspected cases of Thalassemia were studied by HPLC in Department of Pathology in Tertiary Care Hospital from May 2015 to August 2017.

Total 200 subjects were studied, out of which 150 cases were diagnosed as cases of thalassemia based on HPLC values and remaining 50 subjects show normal pattern by HPLC. These 50 cases were taken as normal control group. In the present study HPLC was considered as standard method.

Table 2: Group wise distribution Cases

Group	Diagnosis	No of Cases
A	Beta Thalassemia Major(BTM)	78 (39%)
B	Beta Thalassemia Minor(BTT)	65 (32.5%)
C	Sickel cell-Beta Thalassemia(SBT)	7 (3.5%)
D	Normal	50 (25%)
Total		200

Table No 3: Socio-demographic features of cases among all groups in present study (n=150)

Age wise distribution				
Age (Yrs)	Gr–A (n=78) BTM	Gr–B (n=65) BTT	Gr –C (n=7) SBT	Total
0-10	61(40.67%)	23(15.33%)	5(3.33%)	89 (59.33%)
11-20	17(11.33%)	9(6%)	2 (1.33%)	28(18.66%)
21-30	0	2013.33%)	0	20(13.33%)
31-40	0	8(5.33%)	0	8(5.33%)
41-50	0	5(3.33%)	0	5(3.33%)
Sex wise distribution				
Male	52(66.66%)	38 (58.46%)	4(57.14%)	94(62.66%)
Female	26(33.33%)	27(41.53%)	3(42.85%)	56(37.33%)
Religion wise distribution				
Muslim	31(20.66%)	23(15.33%)	3(2%)	57(38%)
Buddhism	23(15.33%)	21(14%)	2(1.33%)	46(30.66%)
Hindu	22(14.66%)	18(12%)	2(1.33%)	42(28%)
Christian	2(1.33%)	3(2%)	0	5(3.33%)

Maximum study subjects belonged to 0 to 10 years of age. 62.66% of the subjects were Male and 37.33% were female with M: F ratio 1.6:1. Muslims (38%) was the most common ethnic background among all the groups followed by Buddhism (30.66%) then Hindu (28%). Least common was Christian (3.33%). Variations may be due to geographical distribution of cases.

Table 4: Clinical Presentation of cases among all Groups in present study

Clinical features	Group			Total	% out of total 150 Cases
	A (n=78)	B (n=65)	C (n=7)		
Pallor	71	9	0	80	53.33%
Splenomegaly	61	3	0	64	42.67%
Hepatomegaly	36	1	1	38	25.33%
Fever	29	6	2	37	24.67%
Jaundice	33	0	0	33	22%
Join pain	20	1	3	24	16%
Pain abdomen	1	0	0	1	0.67%

Most of the clinical findings were dominantly seen with Group- A i.e. Beta Thalassemia Major. Majority of the cases presented clinically with Pallor 53.33%, Next common presentation was splenomegaly. Other clinical presentation includes- Hepatomegaly, Fever, Jaundice, Joint Pain and abdomen pain. Among all groups most of the clinical presentation was found in 0-10 year's age group.

Table 5: Distribution of cases with Splenomegaly and Hepatomegaly among all groups in present study

Age in year's		0-10	11-20	21-30
Splenomegaly	Gr-A(BTM)	46 (71.87%)	15 (23.43%)	0
	Gr-B (BTT)	3 (4.68%)	0	0
	Gr-C (SBT)	0	0	0
Hepatomegaly	Gr-A(BTM)	23 (60.52%)	13 (34.21%)	0
	Gr-B (BTT)	1 (2.63%)	0	0
	Gr-C (SBT)	1 (2.63%)	0	0

Out of 150 cases 64 cases presented with splenomegaly and 38 cases presented with hepatomegaly. The maximum cases of splenomegaly & hepatomegaly were found in first and second decade.

Table No 6: Mean Hematological Parameters of cases among all Groups in present study

Parameters	Group-A (BTM)	Group-B (BTT)	Group-C (SBT)
Hb (gm %)	7.29	10.13	11.2
RBC (million/mm3)	3.38	4.17	4.35
MCV (fl)	72.01	80.83	75.42
MCH (pg)	22.86	24.09	24.42
MCHC (gm/dl)	29.19	29.61	30.57

- Highest hemoglobin (11.2 gm%), RBC (4.35 million/mm^3) , MCV (80.83 fl), MCHC (30.57 gm/dl) was found in Group C and lowest hemoglobin (7.29 gm%) , RBC (3.38 million/mm^3), MCH (22.86 pg), MCHC (29.19 gm/dl) was found in Beta Thalassemia major i.e. Group A. Highest MCV (80.83 fl) was found in Beta Thalassemia trait i.e. Group B and lowest MCV (72.01 fl) was found in Beta Thalassemia major i.e. Group A.
- Highest hemoglobin (11.2 gm%) was found in Sickle cell Beta Thalassemia i.e. Group C and lowest hemoglobin (7.29 gm%) was found in Beta Thalassemia major i.e. Group A.
- Highest RBC (4.35 million/mm^3) was found in Sickle cell Beta Thalassemia i.e. Group C and lowest RBC (3.38 million/mm^3) was found in Beta Thalassemia major i.e. Group A.
- Highest MCV (80.83 fl) was found in Beta Thalassemia trait i.e. Group B and lowest MCV (72.01 fl) was found in Beta Thalassemia major i.e. Group A.
- Highest MCH (24.42 pg) was found in Sickle cell Beta Thalassemia i.e. Group C and lowest MCH (22.86 pg) was found in Beta Thalassemia major i.e. Group A.
- Highest MCHC (30.57 gm/dl) was found in Sickle cell Beta Thalassemia i.e. Group C and lowest MCHC (29.19 gm/dl) was found in Beta Thalassemia major i.e. Group A.

Table 7: Average Hemoglobin Levels of cases among all Groups in present study

Hb Type	Group –A (BTM)	Group –B (BTT)	Group –C (SBT)
Hb F%	94.44 ±3.1	1.84 ± 2.63	3.22 ± 4.27
HbA%	3.65 ± 2.44	83.50 ± 2.2	47.25 ±20.7
HbA2%	1.53 ± 0.91	5.36 ± 0.69	4.28 ± 0.36
HbS%	0	0	38.68 ±18.5

In Group A average levels of Hb F%, HbA%, HbA2%, HbS% were found to be 94.44 ± 3.13, 3.65 ± 2.44, 1.53 ± 0.91 and 0 respectively. In which Hb F% was highest as compared to other groups. In beta thal trait group average HbA2 level was found to be 5.36 ± 0.69. In Group C average levels of HbA2% and HbS% were found to be 4.28 ± 0.36, 38.68 ± 18.49 respectively.

4. Discussion

In the present study out of the total 200 subjects, 78 cases were of Beta Thal Major, 65 cases of Beta Thal Trait, 7 cases of sickle –beta Thalassemia and 50 members were normal.

The average age of presentation of beta Thal Major was 7.34 yrs. The average age of presentation of Beta Thal Trait was 20.24 yrs. The average age of presentation of sickle –beta Thalassemia was 10.83 yrs. Out of 150 cases; 94 (62.66%) were male and 56 (37.33%) were female with M: F ratio 1.6:1. Hence Study groups show male predominance.

Other Studies

Eshghi, et al[8] (2007) observed out of the 67 patients of thalssemia major, 42 (63%) were male and 25 (37%) were female with M:F ratio 1.68:1 with male predominance. The mean age of patients at the time of study was 9.5±3.7 years.

Mukherjee MB, et al[9] (2010) reported 21 cases of sickle cell- β Thalassemia out of which 11 males and 10 females and M:F ratio was 1.1:1 with male predominance.

Vidja, Prakash J., et al[10] (2011) reported 200 cases of thalssemia major there were 130 males and 70 females and M:F ratio was 1.85:1 with male predominance.

Faruqi Amna, Syed Tousif Ahmed, and Farah Ahmed[11] (2014) in demographic study of thalssemia major found that male predominance. Out of 135 cases of thalssemia major they found 69 (51%) were male and 66 (49%) female with M:F ratio 1.05:1.

Kumar S et al[12] (2017) they studied hematological profile of 211 children with congenital hemolytic anemia and reported that there were 59 cases of thalssemia major of which 38 (64.4%) were male and 21 (35.6%) females, M:F ratio 1.8:1, they also reported 30 cases of thalssemia trait which includes 17 (56.6 %) male and 13 (43.4%) females, M:F ratio 1.3:1. Study showed male predominance.

In the present study Occurrence of Thalassemia was highest in Muslim (38%), followed by Buddhism (30.66 %), Hindu (28%) and least common was Christian (3.33%). Thus the most common affected religion was Muslim followed by Buddhism and Hindu in Group A, B, C.

Other Studies:

Balgir, R. S.[13] (2005) studied 248 cases of thalssemia syndrome and reported that the Khandyat community is at the highest risk of hemoglobinopathies being the high prevalence of β−thalassemia syndrome (30.3%) amongst them followed by Brahmin 21.1%, Karan, Teli and Gauda β−thalassemia syndrome, 9.2%, 8.5% and 5.6%, respectively.

Talsania, Shrenik, Niti Talsania, and Himanshu Nayak[14] (2011) observed that according to religion wise distribution, majority thalassemic patients were Hindu 166 (74.4%) followed by Muslim 57 (25.6%).

Urade BP.[15] (2013) found highest prevalence of beta thalassemia among Sindhi community 97 (10.4%) followed by powar 4 (3.5%).

Pravin M.Meshram et al.[16] (2017) found Buddha (39.3%) was the most common ethnic background among all Hemoglobinopathies followed by Muslims 14%) then Banjara (13.3%).

This is different to the study done by us, this may be due to geographical variation.

Clinical Features

Pallor was most common symptom in present study [53.33%], followed by splenomegaly (42.67%).

In group A (BTM), Pallor (47.33%) was most common symptom followed by jaundice (22%) and fever (19.33%).
Most of the cases in group B (BTT) were asymptomatic, however Pallor (6%) was most common symptom followed by fever (4%). Jaundice was less common.
In group C (SBT), most common symptom was joint pain (2%) followed by fever (1.33%).

Other Studies

Kaur M, Dangi C.B.S, Singh H.[17] (2013) reported 82.1% pallor, 25% jaundice, weakness 70% and body ache 30% among the patients with hemoglobinopathies.

Trehan, Amita, et al[18] (2015) studied clinical profile of 964 cases of thalassemia major and found nearly all (99 %) children had pallor as a presenting complaint. Also found Fever (16.1%) and a small percentage (5%) had jaundice.

Pravin M.Meshram et al.[16] (2017) reported 16 patient of thalassemia major of which Pallor (93.75%) is most common symptom, followed by abdominal pain. Jaundice was less common than other Hemoglobin disorders. they also reported 18 cases of Sickle cell-Beta Thalassemia with maximum patients presented in second decade, with pallor (38.88%) followed by jaundice. Also among 32 cases of thalassemia trait most common presentation was pallor. Finally showed that of all study groups majority of the cases presented clinically with Pallor 49.33%, next common presentation was jaundice. Other clinical features were pain in abdomen and joint pain.

Splenomegaly and Hepatomegaly:

In present study out of 150 cases 64 cases were presented with splenomegaly and out of 64 cases, 49 (46 cases of group A and 3 cases of group B) cases were found in 0-10 year's age group, followed by 15 cases of Group A in 11-20 years age group. Thus the maximum cases of splenomegaly were found in first decade of thalassemia major group.

In Group-A (BTM) out of 36 cases with hepatomegaly, 23 cases were found in 0-10 year's age group and 13 cases were found in 11-20 year's age group. One case in each Group B (BTT) and Group C (SBT) presented with hepatomegaly in age group 0-10 years.

Other Studies

Mukherjee, et al[9] (2010) studied clinical variability of HbS-β thalassemia as mild and sever presentation and reported that the age of presentation varied from 6 months to 18 years and hepatosplenomegaly was observed in both mild and severe cases & splenomegaly was more common in severe cases (87.5%) as compared to milder cases (53.8%).

Kaur M, Dangi C.B.S, Singh H.[17] (2013) studied 120 cases of hemoglobinopathies and found that beta-thalassaemia minor were 64.16%,beta-thalassaemia major 11.66%, Sickle beta-thalassaemia (Hb S/β Thal) 13.33%, Sickle cell trait (Hb AS) 7.50%, Sickle cell Disease (SCD) 2.50% and Hemoglobin E (HbE) were 1% and they observed 15% splenomegaly and 12.14% hepatomegaly among these hemoglobinopathies. Pravin M.Meshram et al.[16] (2017) found, Out of 120 cases of hemoglobin disorders 27 [22.5 %] cases presented with splenomegaly and maximum cases were found in first decade, of which 9 (50.0%) out of 18 cases of Sickle beta-thalassaemia, 15 (93.75%) out of 16 cases of thalssemia major and one case of beta thalassemia trait were presented with Splenomegaly.

Relevant Hematological Parameters:

Table 8: Relevant mean Hematological Parameters in Group A (BTM)

Studies	Hb g/dl	RBC million/mm3	MCV fl	MCH pg	MCHC g/dl
Rao, Seema, et al.[19] (2010)	5.4	2.4	74.9	23.3	31.1
Faruqi,Amna et al [11] (2014)	7.9	2.9	79.3	26.9	33.9
Karim, Md Fazlul, et al[20] (2016)	7.2	-	70	23.8	34.1
Pravin M.Meshram et al. [16] (2017)	4.1	2.31	59	16	27.1
Present study (2017)	7.29	3.38	72.01	22.86	29.19

All the cases in studies were presented with sever anemia with reduced RBC, MCV, MCH and MCHC. In present study maen Hb 7.29 gm%, mean RBC 3.38 million/mm^3, mean MCV 72.01fl, mean MCH 22.86 pg and mean MCHC 29.19 gm/dl. Presentation of cases depends upon duration from last blood transfusion and severity of disease.

Table 9: Relevant mean Hematological Parameters in Group B (BTT)

Studies	Hb g/dl	RBC million/mm3	MCV fl	MCH pg	MCHC gm/dl
Rao, Seema, et al.[19] (2010)	10.3	5.06	68.6	20.5	28.3
Shrivastav, *et al.*[21] (2013)	10.4	5.38	62.1	19.4	30.3
Pravin M.Meshram et al. [16] (2017)	10.1	5.06	66.2	19.9	30.0
Present study (2017)	10.13	4.17	80.83	24.09	29.61

Cases were presented with mild anaemia, normal RBC, reduced MCV, MCH, and MCHC. In present study mean Hb 10.13 gm%, mean RBC 4.17 million/mm^3, mean MCV 80.83 fl, mean MCH 24.09 pg and mean MCHC 29.61 gm/dl. Thus all findings except mean MCV are according to Rao, Seema, et al [60] , Shrivastav, et al.[67] (2013) and Pravin M.Meshram et al. [96] (2017) study.

Table 10: Relevant mean Hematological Parameters in Group C (SBT)

Studies	Hb g/dl	RBC million/mm3	MCV fl	MCH pg	MCHC gm/dl
Rao, Seema, et al.[19] (2010)	7.6	3.49	75.2	21.8	29.2
Mukherjee, et al [9] (2010)	8.99	3.89	68.30	22.76	29.2
Shrivastav, et al.[21] (2013)	7.91	3.62	70.28	22.5	32.1
Pravin M.Meshram et al. [16] (2017)	6.56	2.79	75.5	23.4	31.1
Present study (2017)	11.2	4.35	75.42	24.42	30.57

All the cases in the studies were presented with mild to moderate anemia and reduced MCV & MCH.

In present study mean Hb 11.2 gm%, mean RBC 4.35 million/mm^3, mean MCV 75.42 fl, mean MCH 24.42 pg and mean MCHC 30.57 gm/dl.

Average Hemoglobin Levels:

Table 11: Average Hemoglobin Levels in Group A (BTM)

Studies	HbF%	HbA%	HbA2%	HbS%
Rao, Seema, et al.[19] (2010)	52.5	39.2	3.7	-
Shrivastav, et al.[21] (2013)	78.6	21.2	3.8	-
Present study (2017)	94.44	3.65	1.53	0

In the present study HbF% was 94.4% which is higher than the findings in studies of Rao, Seema, et al [60] and Shrivastav, et al [67], whereas HbA% and HbA2% was 3.65% & 1.53% respectively in present study, which is lower than the findings in studies Rao, Seema, et al [60] and Shrivastav, et al [67].

Table 12: Average Hemoglobin Levels in Group B (BTT)

Studies	HbF%	HbA%	HbA2%	HbS%
Rao, Seema, et al.[19] (2010)	0.1	83.2	5.5	-
Shrivastav, et al.[21] (2013)	1.7	83.3	5.29	-
Present study (2017)	1.84	83.50	5.36	0

In present study, the findings were- mean HbF 1.84%, mean HbA 83.50% and mean HbA2 5.36%.Rao, Seema, et al [60] and Shrivastav, et al [67] haven't mentioned the values of HbS% in their study. Thus our study is consistent with study by Rao, Seema, et al.[60] (2010) and Shrivastav, et al.[67] (2013).

Table 13: Average Hemoglobin Levels in Group C (SBT)

Studies	HbF%	HbA0%	HbA2%	HbS%
Shrivastav, et al.[21] (2013)	2.1	6.22	5.58	70.4
Adekile,Adekunle D.et al.[22] (2017)	12.7	16.0	5.6	67.5
Present study (2017)	3.22	47.25	4.28	38.68

In present study mean HbF 3.22%, mean HbA 47.25%, mean HbA2 4.28% and mean HbS 38.68%. Thus the values of HbA2% in our study is in accordance with the study by Shrivastav, et al.[67] and Adekile, Adekunle D. et al.[82], but the findings of mean HbS% in our study is lower than the values of mean HbS% in study by Shrivastav, et al.[67] and Adekile, Adekunle D. et al.[82].

Average values of LFT & KFT:

Table 14: Average values of LFT & KFT of cases among all groups

Parameters		Gr–A(BTM)	Gr–B (BTT)	Gr–C (SBT)
LFT	SGOT (IU/L)	51.04± 28.85	25.23 ± 4.96	18.85 ± 6.96
	SGPT (IU/L)	53.60± 35.03	28.49 ± 5.28	22.85 ± 1.86
	S.Bilirubin(mg/dl)	1.27 ± 0.75	0.68 ± 0.19	0.71 ± 0.26
KFT	Blood Urea (mg/dl)	25.54 ± 8.39	20.89 ± 5.20	19.28 ± 5.12
	S.Creatinine(mg/dl)	0.51 ± 0.21	0.54 ± 0.22	0.45 ± 0.19

In the present study mean ± SD values of LFT and KFT parameters of all groups were found to be within normal range.

Other studies

Saral, Nishtha, et al [23] (2015) found the activities of the liver enzymes in serum (ALT, AST) were significantly higher in β-thalassemic patients as compared to controls, the values were 36.56 ± 22.05U/L in ALT and 40 ± 23.41U/L in AST. They also observed the value of serum bilirubin level as 0.95 ± 0.62mg/dl.

Karim, Md Fazlul, et al[20] (2016) studied Liver function test in 54 cases of Beta-thalassemia major patients and found AST and ALT levels as 74.8 ±21.7 IU/L & 85.5 ± 26.8 U/L respectively. Also found serum creatinine level as 0.4 +/- 0.2 mg/dl.

Voskaridou, E., et al.[24] (2006) reported mean serum creatinine as 0.78 ± 0.35 mg/dl and did not mention about blood urea for Sickle Beta Thalassemia.

Mansi, Kamal, et al.[25] (2013) Studied Forty two patients with β-thalassaemia major who underwent periodical blood transfusion and were on DFO as chelating agent & found to have blood urea and serum creatinine levels as 33.5±5.50 mg/dl and 0.352±0.113 mg/dl respectively.

Saral, Nishtha, et al [23] (2015) found urea and serum creatinine levels were significantly higher in β-thalassemic patients as compared to controls.

Average values of serum Ferritin:

In the present study mean ± SD value of serum ferritin in Group A were found to be significantly increased (4103.21 ± 2786.9 ng/ml). Whereas serum ferritin of all cases in Group B was not performed, however mean found 44.62 ± 24.51 ng/ml in some cases of Group B who were tested. Serum ferritin was not performed in any cases of Group C (sickle Beta Thalassemia).

Other studies:

Bhagat, Sonali S., et al.[26] (2013) found Serum Ferritin level as 3869.4±996.06 (ng/ml) before supplementation of antioxidants and 3703.27±546.3 (ng/ml) in Beta

thalassaemia major patients which was a non significant decrease in the levels of serum ferritin.

Asif, Mahmood, et al.[27] (2014) found the average values for serum ferritin as 4777.04 ± 13 (ng/ml) for 90 cases of thalassemic patients.
Singh, Dr. Suby et al [28] (2016) studied 100 cases of thalassaemia major and thalassaemia minor, they observed that majority (28%) of the patients had serum ferritin value between 2001ng/ml -3000ng/ml. The mean and S.D. was observed to be 4160+2426 ng/ml.

In present study Mean ± SD value of serum ferritin in Group A was found to be significantly increased (4103.21 ± 2786.9 ng/ml) which may be due to irregular chelation therapy.

5. Conclusion

Standard treatment for beta thalassaemia major is lifelong regular blood transfusion; transfusions should be scheduled in advance and maintained at a fixed schedule. This enables patients and families to establish routines and will improve quality of life.

With increase number of transfusion chances of transfusion transmitted infections increases, also derangement of LFT,KFT and serum ferritin had been observed in many studies, so laboratory tests like CBC, bilirubin, tranaminase and serum ferritin should be checked prior to regular blood transfusion. Antibodies to hepatitis B, hepatitis C, and HIV should also be determined. Apart from this every thalassemic child's family members must go for screening test by HPLC.

Only curative treatment available for these Children currently in India is in form of bone marrow transplant which is out of reach of majority of people. High cost of treatment, repeated blood transfusion and chelating therapy and economic burden on family resources, all suggest that prevention is better than cure.

References

[1] Panja A, Ghosh TK, Basu A. Genetics of thalassemia in Indian population. Journal of Community Nutrition & Health. 2012;1(1):39.
[2] Weatherall DJ, Clegg JB. Inherited haemoglobin disorders: an increasing global health problem. Bulletin of the World Health Organization. 2001 Jan;79(8):704-12.
[3] Caterina Borgna Pignatti, Renzo Galanello.Thalassemias and related disorders; Quantitative disorders of hemoglobin synthesis. In: John P Greer, Job Foerster, George M Rodgen, Frixos Paraskevas, Bertil Glader, Daniel A Arber et al (ed.), Wintrobe's Clinical Hematology,12th edition.Philadelphia: Lippincott Williams & Wilkins. 2009:1083-1118
[4] Tyagi S, Kabra M, Tandon N, Saxena R, Pati HP, Choudhry VP. Clinico-haematological profile of thalassemia intermedia patients. International Journal of Human Genetics. 2003;3(4):251.
[5] Joutovsky A, Hadzi-Nesic J, Nardi MA. HPLC retention time as a diagnostic tool for hemoglobin variants and hemoglobinopathies: a study of 60000 samples in a clinical diagnostic laboratory. Clinical chemistry. 2004 Oct 1;50(10):1736-47.
[6] Rangan A, Handoo A, Sinha S, Saxena R, Verma IC, Kumar S, Sood SK, Bhargava M. Utility of family studies in diagnosing abnormal hemoglobins/thalassemic states. Indian journal of pediatrics. 2009 Jun 1;76(6):615-21.
[7] Biorad: Instruction manual. Variant Beta-Thalassaemia short program. 2006.
[8] Eshghi P, Alavi S, Ghavami S, Rashidi A. Growth impairment in β-thalassemia major: the role of trace element deficiency and other potential factors. Journal of pediatric hematology/oncology. 2007 Jan 1;29(1):5-8.
[9] Mukherjee MB, Nadkarni AH, Gorakshakar AC, Ghosh K, Mohanty D, Colah RB. Clinical, hematologic and molecular variability of sickle cell-β thalassemia in western India. Indian journal of human genetics. 2010 Sep;16(3):154-8.
[10] Vidja PJ, Vachhani JH, Sheikh SS, Santwani PM. Blood transfusion transmitted infections in multiple blood transfused patients of beta thalassaemia. Indian Journal of Hematology and Blood Transfusion. 2011 Jun 1;27(2):65-9.
[11] Faruqi A, Ahmed ST, Ahmed F. Association of Serum Ferritin Levels with Haematological Parameters in Thalassaemia Major Patients. Journal of Rawalpindi Medical College (JRMC). 2014;18(2):219-21.
[12] Kumar S, Singh D, Garg A. An epidemiological study on the clinico-hematological profile of pediatric patients with congenital hemolytic anemia. International Journal of Contemporary Pediatrics. 2017 Feb 22;4(2):374-7.
[13] Balgir RS. Spectrum of hemoglobinopathies in the state of Orissa, India: a ten years cohort study. JAPI. 2005 Dec 1;53:1021-6.
[14] Talsania S, Talsania N, Nayak H. A cross sectional study of thalassemia in Ahmedabad City, Gujarat.(hospital based). Healthline, Journal of Indian Association of Preventive and Social Medicine. 2011;2(1):48-51.
[15] Urade BP. Haemoglobin S and βThal: their distribution in Maharashtra, India. International journal of biomedical science: IJBS. 2013 Jun;9(2):75.
[16] Pravin M.Meshram et al.2017, Study of Clinico-Hematological Profile of Hemoglobinopathies At Tertiary Care Centre. Int J Recent Sci Res. 8(10), pp. 20640-20646. DOI: http://dx.doi.org/10.24327/ijrsr.2017.0810.0932
[17] Kaur M, Dangi CB, Singh H. To study the haemoglobinopathies and ratio of copper and zinc in Sindhi community of Bhopal. International Journal of Pharma and Bio Sciences. 2013;4(1):672-91.
[18] Trehan A, Sharma N, Das R, Bansal D, Marwaha RK. Clinicoinvestigational and demographic profile of children with thalassemia major. Indian Journal of Hematology and Blood Transfusion. 2015 Mar 1;31(1):121-6.
[19] Rao S, Kar R, Gupta SK, Chopra A, Saxena R. Spectrum of haemoglobinopathies diagnosed by cation

exchange-HPLC & modulating effects of nutritional deficiency anaemias from north India. The Indian journal of medical research. 2010 Nov;132(5):513.
[20] Karim MF, Ismail M, Hasan AM, Shekhar HU. Hematological and biochemical status of Beta-thalassemia major patients in Bangladesh: A comparative analysis. International journal of hematology-oncology and stem cell research. 2016 Jan 1;10(1):7.
[21] Shrivastav A, Patel U, Joshi JR, Kaur A, Agnihotri AS. Study of hemoglobinopathies and Hb variants in population of Western India using HPLC: A report of 7,000 cases. Journal of Applied Hematology. 2013 Jul 1;4(3):104.
[22] Adekile AD, Akbulut N, Azab AF, Al-Sharida S, Thomas D. The Sickle β-Thalassemia Phenotype. Journal of pediatric hematology/oncology. 2017 Jul 1;39(5):327-31.
[23] Saral N, Rathore M, Bohra VD, Gupta M. DIAGNOSTIC SIGNIFICANCE OF LIVER & RENAL FUNCTION TESTS (LFT& RFT) IN IRON OVERLOAD IN PATIENTS WITH β-THALASSEMIA MAJOR. International Journal of Clinical Biochemistry and Research. 2015;2(1):27-32.
[24] Voskaridou E, Terpos E, Michail S, Hantzi E, Anagnostopoulos A, Margeli A, Simirloglou D, Loukopoulos D, Papassotiriou I. Early markers of renal dysfunction in patients with sickle cell/β-thalassemia. Kidney international. 2006 Jun 1;69(11):2037-42.
[25] Mansi K, Aburjai T, AlBashtawy M, Abdel-Dayem M. Biochemical factors relevant to kidney functions among Jordanian children with beta-thalassemia major treated with deferoxamine. International Journal of Medicine and Medical Sciences. 2013 Aug 11;5(8):374-9.
[26] Bhagat SS, Sarkar PD, Suryakar AN, Padalkar RK, Ghone RA, Patil SM, Hundekar PS. Attenuation of serum ferritin and iron burden by intake of antioxidants in beta thalassemia major. 2013.
[27] Asif M, Manzoor Z, Farooq MS, Kanwal A, Shaheen U, Munawar SH, Khan IA, Aziz A. Correlation between serum ferritin level and liver function tests in thalassemic patients receiving multiple blood transfusions. 2014.
[28] Singh S, Singh R, Kaul KK, Kour M. Study of Serological Parameters in Thalassemic Patients of GMC Jammu. IOSR Journal of Dental and Medical Sciences (IOSR-JDMS). 2016;15(7):35-52.