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ORIGINAL ARTICLE (STUDENT SECTION)

THE β-THALASSEMIA MAJOR PATIENTS: VARIOUS CLINICAL ASSESSMENTS

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ABSTRACT

The β-thalassemia major is identifiable with the estimation of hematological parameters like (Hemoglobin, Hemoglobin A1, Hemoglobin F, and Hemoglobin A2). In this study, all selected patients were affected with β-thalassemia major. Severely affected hematological values (HB, HCT, MCV, MCHC, WBC and PLT) were observed and affected immunochemistry values (ferritin, vitamin D, serum bilirubin total, serum bilirubin direct, serum bilirubin indirect, SGPT). The beta-thalassemia patients have conceded advancement and metabolic abnormalities that means the criticalness of remedial interventions. The closeness of these varieties from the standard may be a result of iron over-burden and poor nutritional diet. Liver enzyme (SGPT) values are high in beta-thalassemia because iron over-burden (Ferritin) is a primary driving reason for raised liver proteins and it causes liver sickness rheumatoid joint aggravation ailment and hepatic HCV. Bone maladies likewise happen in beta-thalassemia quiet because of deficiency of nutrient vitamin D. Pre-birth screening either thalassemia ailing or transporter and their sub-sequent offspring can be a most ideal approach to decrease the continuous recurrence of thalassemia; just by demoralizing the cousin marriages. Now days, stem cell transplant can cure it, but it is a complex procedure with many risks and won't

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benefit everyone with the condition. Doctors and scientists are working on developing gene therapies and other treatments to help people with beta thalassemia.

Keywords: β-thalassemia, blood CP, ferritin, ALT, vitamin D, blood transfusion.

INTRODUCTION

Thalassemia is a single gene heredity blood disorder; it is transfered from parents to offspring due to premature destruction of red blood cells which leads to anaemia. [1] In thalassemia body cannot make normal forms of haemoglobin. [2] Due to this, body will not be able to take sufficient amount of oxygen and as results patients face many difficulties in long-term survival. It was the first disease which was studied by molecular genetics techniques. The term thalassemia is derived from the Greek word 'thalas' means sea and 'emia' means blood. Thalassemia was not recognised as clinical entity until 1925. [3]

Worldwide there are approximately 240 million people who are the carrier of beta thalassemia. Beta thalassemia is a genetic disorder. [4] It is an autosomal recessive disease. It is caused by reduced or absent of beta globin chain of haemoglobin. [5] Its high prevalence is present in Mediterranean, Middle-East, Central Asia, Indian subcontinent, and Far East. [5] Beta thalassemia occurs when there is a deficiency of beta globin chains; typically it is caused by direct down regulation in the synthesis of structurally normal beta chains. [6] The β-thalassemia is inherited as an autosomal recessive manner. At conception, each sibling of an affected individual has a 25% chance of being affected, a 50% chance of being an asymptomatic carrier, and a 25% chance of being unaffected and not a carrier. [7] In beta thalassemia there is defect in beta globin gene, while beta globin is encoded by two genes. [8]. More than 200 mutations affecting the beta globin gene are now known to result in a phenotype of beta thalassemia. [6] Beta thalassemia can be classified into three categories: Thalassemia major, thalassemia intermediate, thalassemia minor. [9]

Patients of beta thalassemia minor have no symptoms and they spend a normal life and beta thalassemia intermediate patients have moderate anaemia, while patients of beta thalassemia major have severe anaemia and they require blood transfusion. [4] But the repeated transfusion can cause iron overload and because of this many disorders occurs like endocrine dysfunction, cardiomyopathy and liver disease afterward it leads patients to death. But if the blood transfusion does not take place then patient of beta thalassemia major will die on first five years of their life. [10] Natural pharmacological agents have been used to reduce iron over loaded in patients of beta thalassemia major. [4] In beta thalassemia, beta globin is not formed because of mutation. There are several types of mutations take place in beta globin gene which causes beta thalassemia. The mutation in beta globin gene is due to the single nucleotide.

The possible treatment of beta thalassemia contains bone marrow transplantation, which is very expensive and unaffordable for Pakistani patients. So the best way to prevent the future generation from this hazardous disease is to diagnose the both parents before they conceive a baby. If the parents are carriers of beta thalassemia then provide them a proper counselling for prenatal diagnosis in the 1st trimester of pregnancy to check either the fetus is affected or not. [11]

In this study, we observed clinical assessment of beta thalassemia major patients under trials of treatment.

MATERIALS AND METHODS

The study was conducted over four months in 2019. Blood samples collected from Fatmid Foundation Blood Center Hyderabad, Pakistan. The β-thalassemia major diagnosed patients were registered and they were following the regular schedule of blood transfusion. We selected 5 patients of β-thalassemia major. The samples were collected using ethylenediaminetetraacetic acid (EDTA) tubes. On these samples we performed hematological and biochemical test at LUMHS diagnostic laboratory Hyderabad Sindh.

Hematological and Immunochemistry test of β-thalassemia:

Blood samples were subjected for diagnosis of thalassemia. Hematological and immunochemistry parameters of blood including RBC count (million), hemoglobin (gm/dl), hematocrit (%), MCV (fL), MCH (g/dL), MCHC (g/dl)[12], hemoglobin A1 (%), hemoglobin F (%), hemoglobin A2 (%), WBC (U/L), neutrophils (%), lymphocytes (%), monocytes (%), eosinophils (%), basophils (%), platelet count (10^9/L), ESR (mm/hour), vitamin D total (ng/mL), serum iron (µg/dl), serum TIBC (µg/ml), ferritin (ng/ml), transferrin saturation (%), serum bilirubin total (mg/dl), serum bilirubin direct (mg/dl), serum bilirubin indirect (mg/dl), SGPT (ALT) (U/L), alkaline phosphatase (U/L), gamma GT (U/L), plasma glucose random (mg/dl), serum creatinine (mg/dl), T3 (ng/ml), T4 (µg/dl), TSH (µU/ml)and blood urea (mg/dl) estimated with an automatic analyzer.[13-15]

RESULTS AND DISCUSSION

As per the hematological and immunochemistry parameters of blood β-thalassemia major patients' uncovered noteworthy variety are surpassing over to the reference esteems. The thalassemia patients showed significantly lower values of hematological characteristics than healthy person values of hemoglobin (Hb), hematocrit (HCT), Red Blood Cells (RBCs), white blood cells (WBCs), while ESR and platelets (PLT) were higher (Table 1).

The thalassemia patient showed significantly same values of hematological characteristics than healthy person values of mean corpuscular hemoglobin (MCV) and mean corpuscular hemoglobin concentration (MCHC), Mean corpuscular hemoglobin (MCH). [12]

Table 1. Analysis of hematological parameters among β-thalassemia major patients

Characteristics	Healthy	Patient-I	Patient-II	Patient-III	Patient-IV	Patient-V
RBC (million)	4.415±	3.545±	3.485±	9.018±	3.248±	3.514±
4.3-5.9 (million)	0.036	0.027	0.017	0.041	0.257	0.018
Hemoglobin (g/dl)	11.08±	9.700±	9.600±	7.100±	10.00±	9.750±
12.0-16.0 (g/dl)	0.125	0.071	0.082	0.129	0.082	0.104
Hematocrit (%)	43.03±	29.75±	29.03±	21.13±	30.50±	29.90±
	0.085	0.065	0.149	0.048	0.204	0.187
M.C.V (FL)	79.10±	83.38±	83.50±	77.96±	87.05±	84.75±
76-96 (FL)	0.173	0.156	0.187	0.165	0.104	0.250
M.C.H (g/dl)	29.13±	27.22±	27.60±	26.50±	28.60±	27.63±
27-31	0.236	0.085	0.041	0.082	0.082	0.063

Characteristics	Healthy	Patient-I	Patient-II	Patient-III	Patient-IV	Patient-V
M.C.H.C (g/dl)	33.00±	32.73±	33.00±	34.08±	32.80±	32.40±
32-36 (g/dl)	0.082	0.085	0.071	0.111	0.041	0.071
Hemoglobin A1 (%)	96.03±	95.83±	90.75±	96.03±	96.43±	96.40±
95.0-99.0 (%)	0.085	0.048	0.065	0.085	0.085	0.071
Hemoglobin F (%)	1.600±	1.000±	6.200±	1.400±	0.600±	0.600±
< 2.0 (%)	0.041	0.041	0.041	0.082	0.041	0.041
Hemoglobin A2 (%)	3.200±	3.200±	3.100±	2.600±	3.000±	3.025±
< 3.7(%)	0.041	0.041	0.041	0.082	0.041	0.025
WBC (u/l)	7.800±	5.255±	7.925±	3.920±	2.490±	1.222±
4.0-10 (u/l)	0.041	0.016	0.031	0.012	0.022	0.010
Neutrophils (%)	59.93±	64.98±	55.48±	32.43±	26.75±	42.63±
40-75 (%)	0.214	0.085	0.085	0.063	0.065	0.125
Lymphocytes (%)	28.00±	25.33±	34.70±	57.40±	64.80±	42.28±
20-45 (%)	0.082	0.063	0.071	0.147	0.141	0.103
Monocytes (%)	4.188±	6.525±	6.725±	9.425±	3.975±	6.300±
2.0-10.0 (%)	0.010	0.048	0.063	0.085	0.048	0.082
Eosinophils (%)	2.500±	2.700±	2.700±	0.400±	4.025±	8.175±
1.0-6.0 (%)	0.041	0.041	0.041	0.041	0.063	0.063
Basophils (%)	0.225±	0.600±	0.500±	0.325±	0.425±	0.575±
< 1 (%)	0.025	0.041	0.041	0.025	0.025	0.025
Platelet count (10^9/l)	202.0±	183.5±	314.0±	180.5±	421.0±	399.0±
150-400 (10^9/l)	2.614	0.646	0.913	2.533	3.136	2.483
ESR (mm/1hr)	11.00±	76.50±	24.75±	22.00±	85.00±	16.25±
0-25 (mm/hr)	0.408	1.041	0.250	0.408	0.408	0.250

Some thalassemia understanding indicated high and some thalassemia tolerant demonstrated low estimations of hematological attributes than solid individual qualities like monocytes, eosinophils, basophils, lymphocytes, hemoglobin A1, hemoglobin F and hemoglobin A2. Level of ferritin was very high in all beta thalassemia patients than healthy ones. These levels reflect inadequate chelation and vulnerability to develop iron overload related complications. The serum ferritin level increases as the frequency of blood transfusion and the age of the patient increases. Liver enzyme (SGPT) values were high in beta-thalassemia understanding. Vitamin D level was very low in beta thalassemia patients, high prevalence of vitamin D deficiency was seen in beta thalassemic patients that may largely contribute to their bone diseases.

Table 2. Analysis immunochemistry parameters among β-thalassemia major patients

Characteristics	Healthy	Patient-I	Patient-II	Patient-III	Patient-IV	Patient-V
Vitamin D Total (ng/mL)	10.12±	3.455±	5.354±	4.224±	2.999±	6.652±
RF values (ng/mL)	0.287	0.125	0.126	0.129	0.125	0.085
Serum Iron (ug/dl)	120.4±	129.8±	191.3±	158.3±	252.6±	186.5±
33.0-193.0 (ug/dl)	29.53	1.631	1.350	0.558	1.459	0.898
Serum TIBC (ug/ml)	289.8±	202.8±	218.0±	146.0±	245.0±	211.5±
250-400 (ug/dl)	2.056	2.250	1.871	1.291	1.472	1.323
Ferritin (ng/ml)	180.3±	4469±	1971±	3561±	7475±	1520±
20-200 (ng/mL)	1.652	3.894	4.697	4.029	1.652	3.708
Transferrin Saturation (%)	58.28±	63.75±	88.25±	108.0±	101.8±	87.60±
RF values (%)	0.782	0.323	0.722	1.472	1.784	0.704
Serum Bilirubin total (mg/dl)	0.610±	0.770±	1.686±	1.405±	1.453±	0.478±
0.10-1.00 (mg/dl)	0.013	0.004	0.015	0.013	0.006	0.013
Serum bilirubin Direct (mg/dl)	0.268±	0.250±	0.370±	0.370±	0.490±	0.200±
≤ 0.3 (mg/dl)	0.017	0.004	0.008	0.008	0.004	0.008
Serum Bilirubin Indirect (mg/dl)	0.7	0.52	1.33	1.0125	0.96	0.2825
0.25-0.9 (mg/dl)	0.008165	0.01225	0.0082	0.02175	0.008165	0.00854
Plasma Glucose Random (mg/dl)	120	76.25	73.25	89.25	135.25	91.5
80-160 (mg/dl)	0.816497	0.85391	0.25	0.62915	1.108678	0.6455
Serum Creatinine (mg/dl)	0.455	0.4375	0.6675	0.25	0.37	0.4075
0.40-0.60 (mg/dl)	0.012583	0.00479	0.0085	0.00816	0.007071	0.00854
Blood Urea (mg/dl)	27.75	18.5	23.25	18	17.75	18.25
15-50 (mg/dl)	0.478714	0.6455	0.4787	0.40825	0.478714	0.25

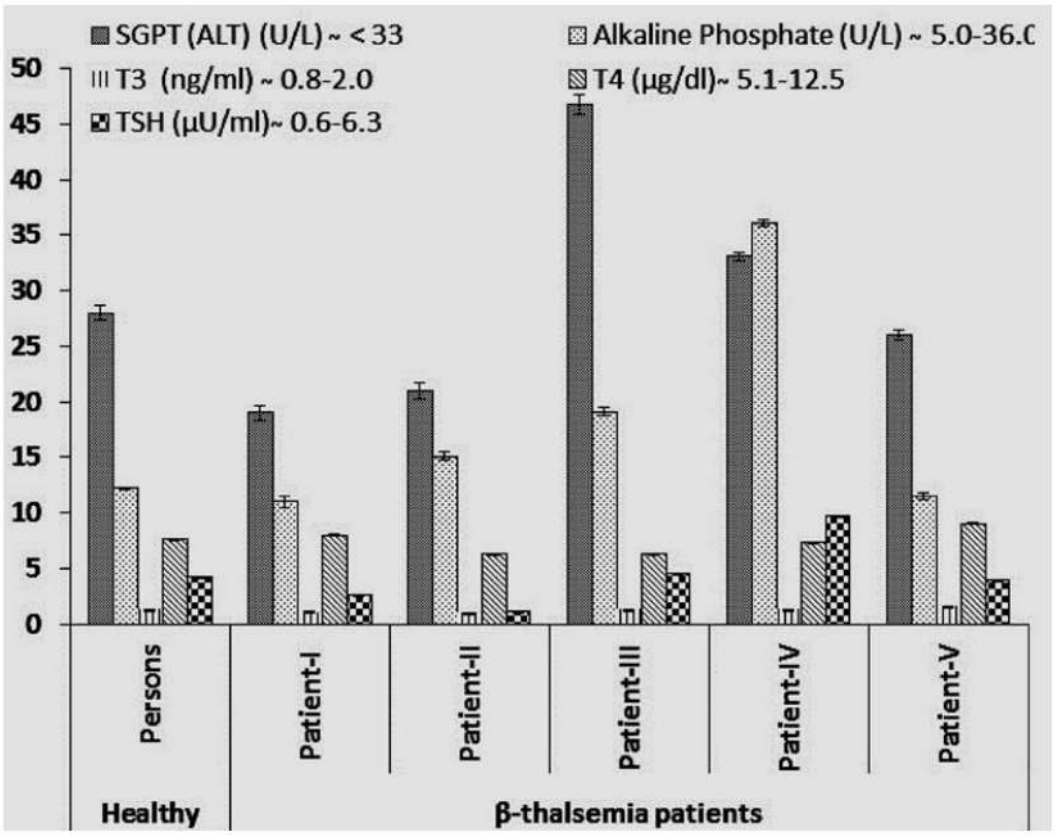

Figure 1. Analysis of thyroid profile and reno-hepatic enzymes activities assessment in the β-thalassemia major patients

The β-thalassemia major is identifiable with the estimation of hematological parameters (Hemoglobin, hemoglobin A1, hemoglobin and hemoglobin A2). In this study, all selected patients were affected with β-thalassemia major. Severely affected hematological values (Hemoglobin, HCT, MCV, MCHC, WBC and platelets) were observed; and also affected immunochemistry values (Ferritin, vitamin D, serum bilirubin total, serum bilirubin direct, serum bilirubin indirect, SGPT). Beta thalassemia major patients have conceded advancement and metabolic abnormalities that means the criticalness of remedial interventions. The closeness of these varieties from the standard may be a result of iron over-over-burden and poor nutritional diet. [16]

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CONCLUSION

Pre-birth screening either thalassemia ailing or transporter and their sub-sequent offspring can be a most ideal approach to decrease the continuous recurrence of thalassemia, just by demoralizing the cousin marriages. Now days, stem cell transplant can cure it, but it is

a serious procedure with many risks and won't benefit everyone with the condition. Doctors and scientists are working on developing gene therapies and other treatments to help people with beta thalassemia.

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