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Complications Due To Blood Transfusion in Thalassemic Patients in the Health Care System of Ajk

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ABSTRACT: Thalassemia is a hereditary blood disorder caused by a defect in one or both chains of hemoglobin. It reduces the oxygen-carrying capacity of hemoglobin, causing oxygen deficiency that may affect vital body organs. Blood transfusion remains the only accessible, affordable, and reliable treatment for thalassemia patients. However, the frequent transfusion of blood makes the patient vulnerable to certain complications. The primary complication is iron overload, which may lead to secondary complications. In our study, the complications of blood transfusions in thalassemic patients were studied in public sector hospitals of AJK. The parameters of the study are lab reports of serum ferritin, CBC, LFT, RFT, and CRP. Data is presented in the form of graphs and tables using Ms Excel and google docs. Various blood transfusion-related complications were found in our study. The major complications were iron overload, which was attributed to the 92.85% abnormal serum ferritin level. 80% of the patients were anemic due to low hemoglobin levels. 51.28% of patients were at risk of developing jaundice and anemia due to high levels of bilirubin. 72.09% of patients had high ALT levels, leading to the risk of liver failure, and enzymatic and metabolic disturbance. 72.72% of patients had increased CRP levels which indicates inflammation in the major organs such as the heart, liver, and kidney. The purpose of this study is to comprehensively evaluate all of the available evidence-based literature.

KEYWORDS: Thalassemia, Blood transfusion, Iron Overload

I. INTRODUCTION

[1].Thalassemia is an autosomal recessive inherited disease resulting from mutations in the α- and β-globin gene clusters on chromosome 16 and chromosome 11, respectively.

[2].Thalassemia is reported to be one of the top five types of major birth defects.

[3].(αα/α−) Silent α- thalassemia carriers have no signs or symptoms of thalassemia but will transmit it to their children.

[4].α - thalassemia trait is mostly caused by missing one or both alpha globin genes. In hemoglobin [Hb] H disease, ¾ α-globin genes are affected, Hb Bart hydrops fetalis syndrome is clinically the most severe among all the other alpha thalassemia clinical conditions. In it, all four α globin genes are missing. In place of Hb F and Hb A, the Fetal blood contains mainly Hb Bart (gamma4) and small amounts of hemoglobins. In β- thalassemia β- globin chains are affected.

[5].In β- thalassemia trait the sufferers are usually asymptomatic however a little renal tubular malfunctioning is reported.β- thalassemia major is also known as transfusion-dependent thalassemia (TDT). The patients clinically represent severe anemia which ranges from Hb <7g/dl. Hepatic and splenic enlargement is seen, and frontal bossing is there.

[6].The signs and symptoms of Beta Thalassemia include excessive anemia, abdominal expansion due to hepatosplenomegaly, bad musculature, genu valgum, and extramedullary hematopoiesis.

[7]. Blood transfusion is the only affordable treatment for TDT. However, frequent blood transfusion has also led to iron overload with many other complications including transfusion-related infections. The accumulation of iron contained in transfused red blood cells is responsible for tissue damage.

[8]. Since each cell pack unit contains approximately 200 mg of iron, a patient receiving 25 units per year accumulates 5 grams of iron per year in the absence of chelation. Add to this the increased intestinal absorption of iron seen in these patients. By the early third decade, a patient with thalassemia major in the absence of chelation would have accumulated 70 grams of iron. The consequence of this is that vital organs such as the

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heart, liver and endocrine glands become loaded with iron and their function progressively deteriorates.
[9]. Despite the use of iron chelation therapy, the pituitary gland, peripheral endocrine tissues, and the gonadal axis are all susceptible to iron deposition and damage.
[10]. Delayed puberty was the most common endocrine complication (40.5%).
[11].Iron suppresses bone remodeling apparently by decreasing osteoblast formation and new bone synthesis leading to osteoporosis.
[12]. Transfusion-transmitted infections (TTIs) are a major risk in developing countries. The main TT viruses of clinical importance are the human immunodeficiency virus, the hepatitis C virus, and the hepatitis B virus.
[13].Transfusion-related acute lung injury (TRALI) is usually caused by specific anti-neutrophil or anti-HLA antibodies activating the patient's neutrophils, characterized by dyspnea, tachycardia, fever, and hypotension during or within six hours after the transfusion.
[14].Currently, TACO is the leading cause of transfusion-related morbidity and mortality worldwide, occurring in 1% to 12% of at-risk populations.
[15].Blood transfusion is not a simple procedure like water and electrolyte infusion, but it is a kind of temporary tissue transplant and alloimmunization is a reaction that resembles tissue rejection.
[16]. Despite blood transfusion treatment strategies also suggest bone marrow transplant and many children show positive feedback to this treatment.
[17]. Deferoxamine is considered the parent drug for iron chelation which is in use for the last four decades and is administered parenterally whereas, another drug used for chelation therapy is deferiprone which is active orally.

II. MATERIALS & METHODS

The main objective of our study was to access complications due to blood transfusions in thalassemia patients of AJK. Specifically, our target was to estimate blood transfusion complications through analysis of lab reports of CBC (hemoglobin), Serum ferritin, Liver Function tests (LFTs), Renal Function tests (RFTs), and C-reactive Proteins (CRP).

We collected lab reports between April and June from Sheikh Khalifa Bin Zayed Al Nahyan (CMH) Hospital, District Headquarters (DHQ) Hospital Kotli and Abbas Institute of Medical Sciences (AIMS) Muzaffarabad AJK) and evaluated them by comparing them with standard values.

Firstly, we collected Patient information/demographics which included their age, area, and socio-economic status. Brief family history is taken to pinpoint the exact source behind the occurrence of the disease. Along with that, their social history is also taken which will be helpful to identify the source of the illness. We evaluated laboratory tests for confirmation of the presence of illness. We evaluated 64 samples of laboratory data which were compiled in Ms. Excel and Google Docs.

III. RESULTS & DISCUSSIONS

We evaluated lab reports of 64 thalassemia patients, collected from different hospitals (Abbas Institute of medical sciences Muzaffarabad, Sheikh Khalifa Bin Zayed Al Nahyan Hospital (CMH) Rawalakot and District Health Quarter Kotli) of Azad Jammu and Kashmir.The main parameters of our evaluation were Serum ferritin, Hemoglobin, RFTs (Urea, creatinine), LFTs (Bilirubin, ALP, ALT), and CRP which are indicative of the normal/abnormal functioning of different significant organs.

According to the study both parents of the thalassemic patient were blood relatives, first cousins, belonged to the lower-middle class of the society with poor financial support, and were residents of rural areas.

The normal ranges and average values of all these parameters are as follows:

Indicative Parameter	**Normal Ranges**	**Averages**
Serum ferritin	20-250ng/ml	3209.818214 ng/dL
Hemoglobin	11.5-15.5g/dl	8.649019608 g/dL
Urea	17-43 mg/dL	26.0490625 mg/dL
Creatinine	0.5-1.2 mg/dL	7.126756757 mg/dL
Bilirubin	<0.1 mg/dL	4.375641026mg/dL

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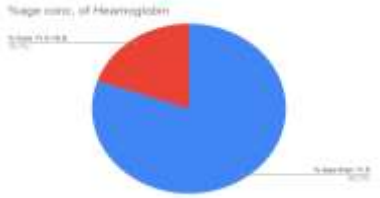
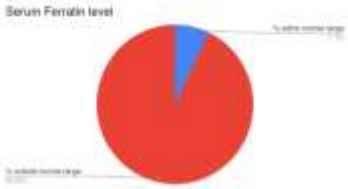
ALP	0-645 U/L	395.5245 U/L
ALT	10-45 U/L	83.38139535 U/L
CRP	Less than 6 mg/L	11.52173913 mg/L

Table 1: Normal ranges and Averages of the evaluated Lab reports



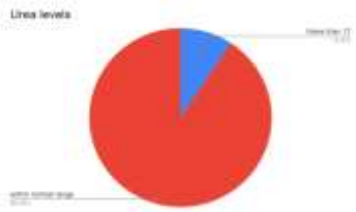
Graph 1: Range of Hemoglobin

A complete blood Count (CBC) gives an insight into the patient's hemoglobin levels in the body. In the evaluated patients, even after continuous blood transfusions, the level of hemoglobin remained quite low, at an average of 8.64g/dL. Almost 80% of the patients have low hemoglobin levels, as shown in graph 1 indicating a constant need for blood transfusion to maintain a good Hb level.

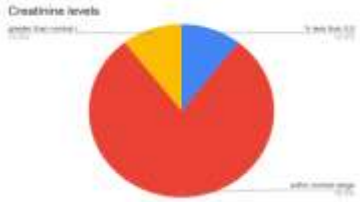


Graph 2: Normal and abnormal serum ferritin level

In the evaluated lab reports, 92.85% of the patients were at the risk, or have already developed iron overload, while only 7.1% of the patients were within the normal range, as shown in graph 2. Increased serum ferritin may lead to various other complications ofliver, heart, and endocrine glands due to poor metabolism and excretion.
In Renal Function Test (RFT) we examined the urea and creatinine levels.

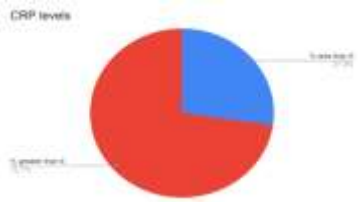


Graph 3: Range of Urea levels



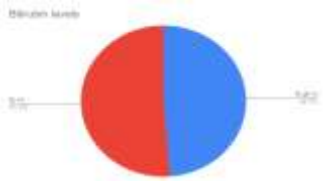
Graph 4: levels of creatinine

It was observed that 90% of the patients have normal urea levels while 76% of the patients had normal creatinine levels, as shown in graphs 3 & 4. It is conclusive that thalassemia patients may not or rarely develop kidney complications.



Graph 5: Normal and abnormal value of CRP

C-reactive protein (CRP) is a significant marker of inflammation in various body organs. In the collected lab reports, we observed that 72.72% of the patients had increased CRP levels, represented in graph 5. It may refer to the presence of inflammation in the heart, liver, or kidneys.
In Liver Function Test (LFT) Alanine transaminase (ALT), Alkaline phosphatase (ALP), and bilirubin are the major markers.



Graph 6: Normal & abnormal values of Bilirubin

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Graph 7: percentages of ALP
Graph 8: levels of ALT

In the given study, we observed that 48.71% had normal bilirubin levels while 51.28% had increased levels of bilirubin, as shown in graph 6. This gives a high probability among the patients to develop jaundice and anemia.

The next important parameter is ALT. In the study under discussion, 72.09% of patients had ALT levels outside the normal range, as shown in graph 7. This can be an indication of liver injury. Surprisingly, 90% of the patients had normal ALP levels. So, from these three parameters, it can be drawn that liver complications can occur in thalassemia patients and if not monitored properly, can lead to liver failure.

According to our study, the first common complication in thalassemia patients is iron overload, due to increased serum ferritin levels. This is followed by liver complications, mainly due to abnormal bilirubin and ALT levels. Lastly, CRP is a major contributor to inflammatory complications in the major organs.

IV. CONCLUSION

Major blood transfusion complications observed in our study are iron overload, liver dysfunction, and inflammation. These complications contribute to various symptoms such as jaundice, growth retardation, and splenomegaly, cardiac complication due to inflammation of the myocardium, fatigue, and weakness. These complications can be managed by trying out other treatments along with blood transfusion and iron chelation therapy to reduce the iron. The development of a safe drug regimen can help prevent the occurrence of these complications. Along with that, awareness among health care professionals about safe blood transfusion can prevent various risk factors. A sound education program for the general population about the health hazards of cousin marriages can prevent thalassemia and a lot of economic, social, and health issues arising due to this disease. Premarital carrier screening and counseling of high-risk individuals can play a decisive role in the elimination of thalassemia. Pharmacists can play an important role in not only the awareness and counseling about thalassemia but also the management of the disease.

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