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Original Research Article

A Practical Study on the Relationship between Serum Iron Elevation and Liver Enzymes Plus Other Factors in Patients with Beta-Thalassemia

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Abstract: Thalassemia is a genetic condition characterized by faulty hemoglobin synthesis and low hemoglobin concentration. Overload of iron is an unavoidable condition experienced by severe thalassemia patients as a result of excessive blood transfusions. We looked at impaired liver function in thalassemia individuals with Iraq as a result of these issues. Our findings demonstrated serum activity in hepatocytes, as well as a large rise in GOT and AIP in patients with elevated iron levels and a substantial rise in TSB. All of these elements may work together or independently to create chronic liver disease by causing damage in cells via oxidative mechanisms.

Keywords: Beta-thalassemia, liver function, Iron overload.

INTRODUCTION

Thalassemia is a diverse group of genetically inherited hemoglobin (Hb) production abnormalities [1]. It is the most widespread monogenic disease in the world [2], affects both men and women equally [3], and has a significant health and economic impact on patients as well as their households [4]. Thalassemias are characterized as alpha (α) or beta (β) thalassemia based on the impacted globin chain synthesis [5]. Beta thalassemia major, known a Cooley anemia, is perhaps the most severe type of β-thalassemia [6]. It produces severe anemia in the initial year of life, necessitating red blood cell transfusions every 4or 6 weeks [7].

Over the last nearly three decades, the introduction of frequent donor therapy and iron chelation has significantly enhanced quality of life and changed thalassemia from a swiftly lethal condition to an ongoing illness with a long lifetime [8]. Regarding the rising longevity rate of persons with thalassemia, difficulties continue to arise [9]. Unfortunately, the numerous blood transfusions required to treat thalassemia major cause iron accumulation in the body [7]. Therefore, persistent blood transfusions in thalassemic patients are a double-edged sword [10]. Excessive iron intake can harm the circulatory system, heart, and hormonal glands, resulting in serious and occasionally fatal complications [11]. It is widely acknowledged that cardiac disease contributes for 70% of mortality in severe thalassemia patients [12, 13]. In β-thalassemia major patients, liver disease has emerged as the primary cause of death in recent times. However, insufficient research has been done on the clinical significance of liver damage linked to β-thalassemia [14].

Hepatomegaly, elevated the amino acid glutamine and transcription factors aminotransferase activity, and hepatitis B and C are all possible symptoms of liver illness. Significant fibrosis is usually influenced by iron overload, which can be caused by excessive transfusion, poor chelation, erythrocyte breakdown, and increased consumption of iron from the gut due to defective erythrocyte. Because hepatocytes are the body's primary location of iron preservation, iron overload leads these cells to be repeatedly attacked by reactive oxygen species, eventually leading to their death. Within a year of the transplantation, damage to these cells (hepatocytes) begins [11-15]. To the greatest of the researcher's knowledge, there has never been a comprehensive investigation into the role of iron overload without concomitant viral hepatitis B and Cas a cause of liver injury in Iraqi Thalassemic individuals.

In the present investigation, we assessed the relationship between the degree of hepatocellular damage as shown by levels of biochemical markers known as the "liver function test" and the reflected iron situation.

MATERIALS AND METHODS

The present investigation is a case-relationship research that took place during October 2nd, 2022 and April 2nd, 2023 at Ibn Al-Bladee Hospital's Thalassemic center in Baghdad, Iraq. This study enrolled 64 patients with heterozygous β-thalassemia severe and no liver disease, referred by their specialist. The patients' subjects were separated into male and female categories. Based exclusively on Hb electrophoresis results and Thalassemic individuals who had negative qualitative tests for hepatitis B/C viruses, β-thalassemia major was diagnosed. The participants were questioned and clinically examined, namely for abdominal soreness and hepatomegaly. Hepatomegaly was identified clinically and confirmed with an abdominal ultrasound (U/S). The patients and their parents provided general and other pertinent information, particularly about any past history of hepatic illness. We obtained 7.0ml of arterial blood from every individual in this investigation and assessed the iron content. On the identical day, the remaining serum was used to measure the following: alkaline phosphatase (ALP), calcium (Ca), glucose (GLU), aspartate aminotransferase (AST-GOT), aminotransferase alanine (ALT-GPT), and total serum bilirubin (TSB). We measured compacted volume of cells and hemoglobin using the widely recognized the Microhematocrit Technique. Using a kit supplied by ELISA, the ron concentration in the blood of every participant in this study was assessed by (EIA).

RESULTS

Within this research, the patients' age ranged from one year to 38 years. The study cases included 33 males and 31 females. Males and females with thalassemia had mean pretransfusion hemoglobin levels of 88.33±13.84g/L and 87.85±13.21g/L, respectively. The serum iron level was determined, as well as the serum activity of liver enzymes (GOT, GPT, and ALP), TSP, Ca, and Glu. We attempted to determine the links between iron, liver enzymes, and other subjects, and discovered a low association between iron and GPT, with no significant correlation (Fig 1).

But we see a significant positive correlation ($p \leq 0.05$) between Iron and GOT (Fig 2) and very low significant correlation between Iron and ALP (Fig 3).

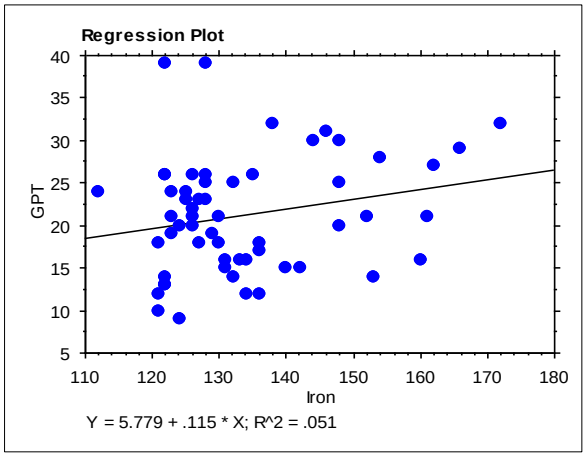

Figure 1: Relationship between Iron and GPT in thalassemia patients

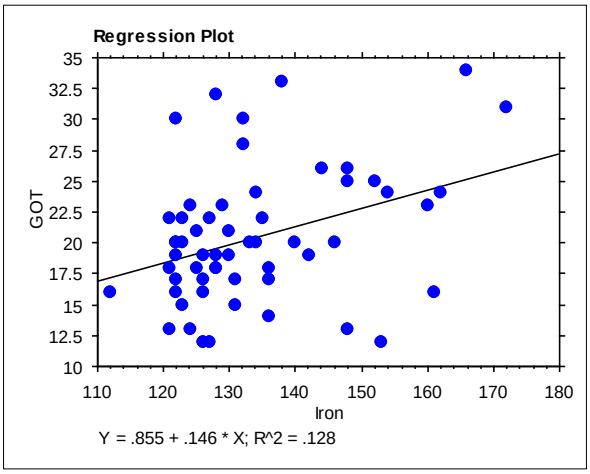

Figure 2: Relationship between Iron and GOT in thalassemia patients

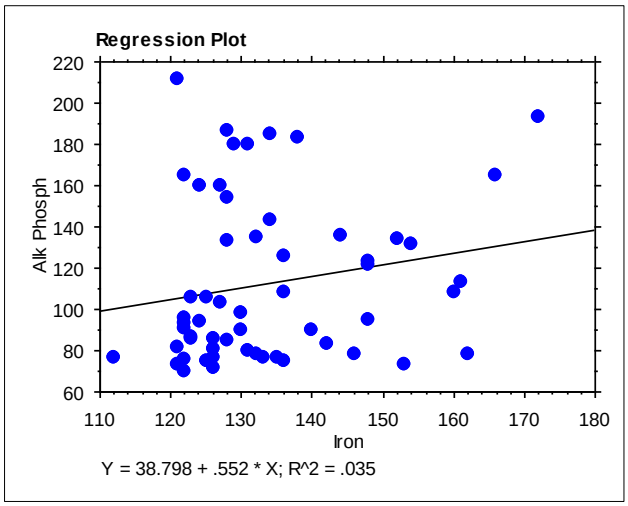

Figure 3: Relationship between Iron and ALK in thalassemia patients

And very good positive correlation ($p \leq 0.001$) between Iron and TSP (Fig 4) and No relationships between Iron and Ca (Fig 5) and low negative correlation between Iron and GlU (Fig 6) and good negative significant correlation between Iron and Hb (Fig 7).

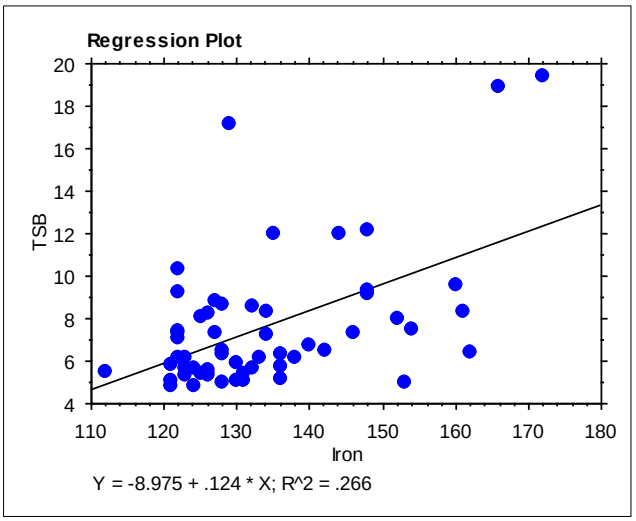

Figure 4: Relationship between Iron and TSP in thalassemia patients

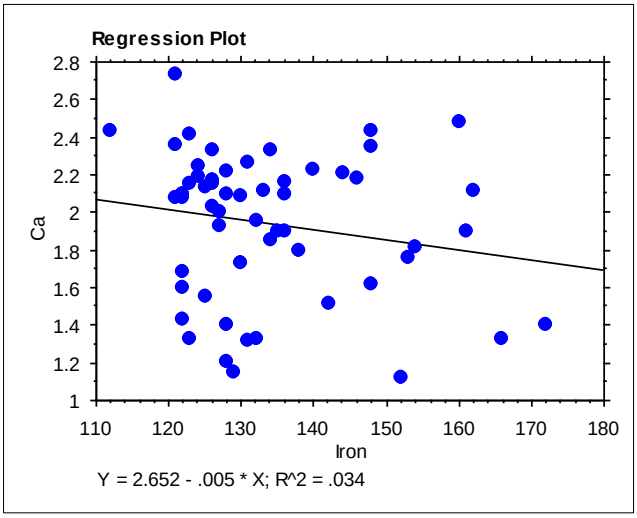

Figure 5: Relationship between Iron and Ca in thalassaemic patients

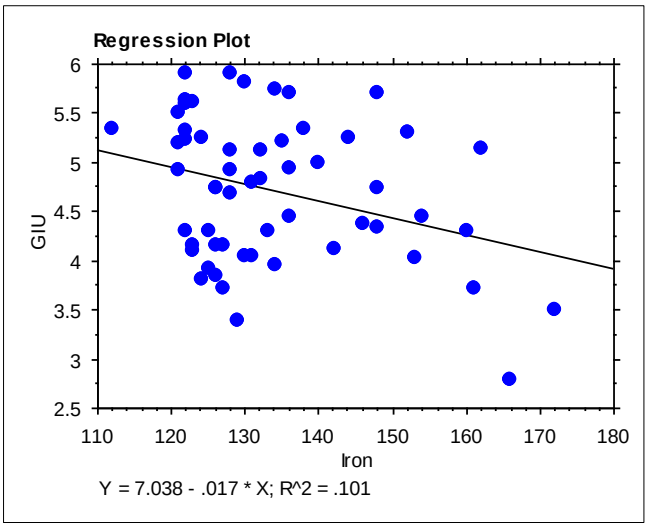

Figure 6: Relationship between Iron and GlU in thalassemia patients

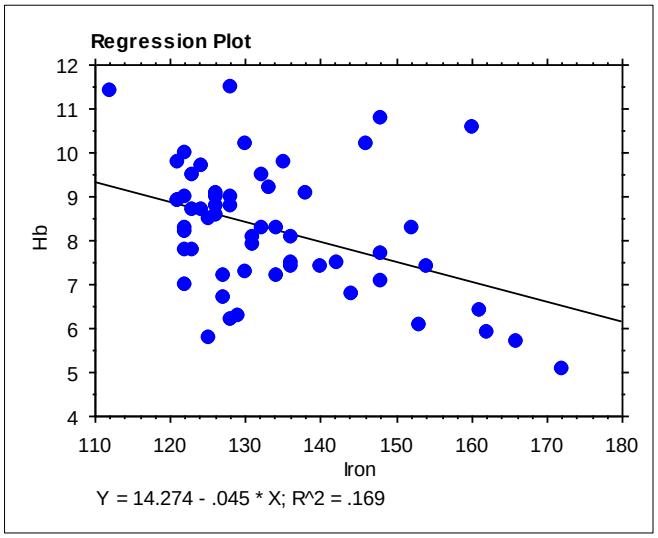

Figure 7: Relationship between Iron and Hb in thalassemia patients

And we investigated the relationship between Hb and GPT, GOT, and ALT, we found NO significant correlation (Fig 8, 9, 10).

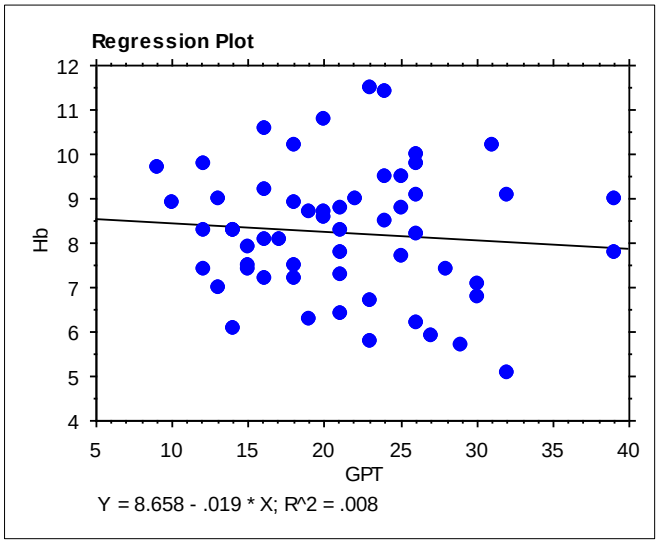

Figure 8: Relationship between GPT and Hb in thalassemia patients

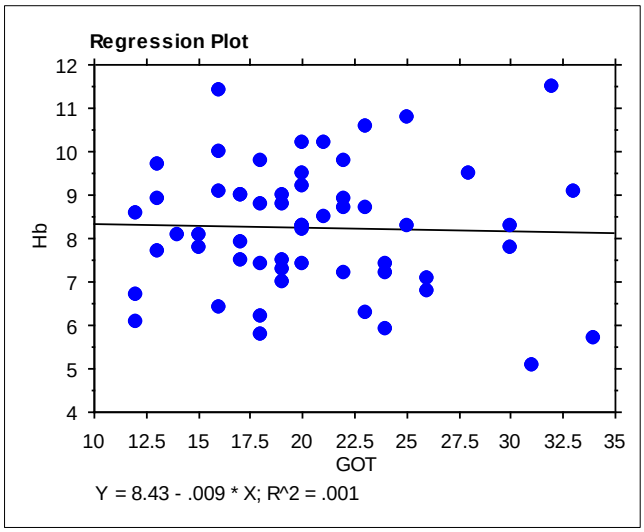

Figure 9: Relationship between GOT and Hb in thalassemia patients

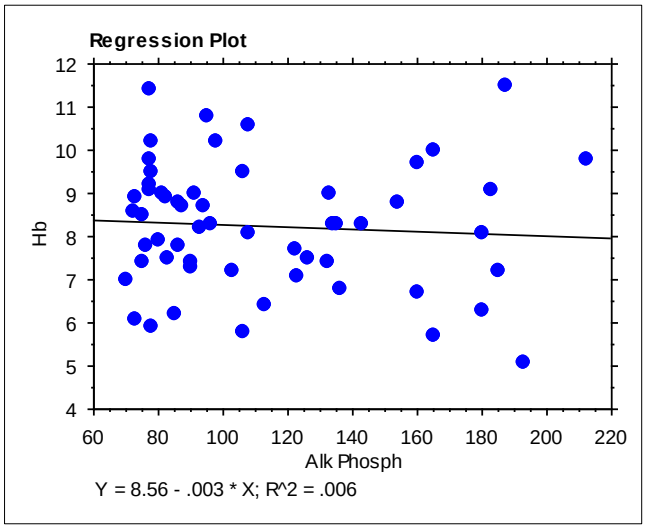

Figure 10: Relationship between ALK and Hb in thalassemia patients

But we see a good negative correlation between Hb and TSB (p≤0.001) (Fig 11) and a Low positive correlation between Hb and Ca (Fig 12) very Low positive correlation between Hb and Glu (Fig 13).

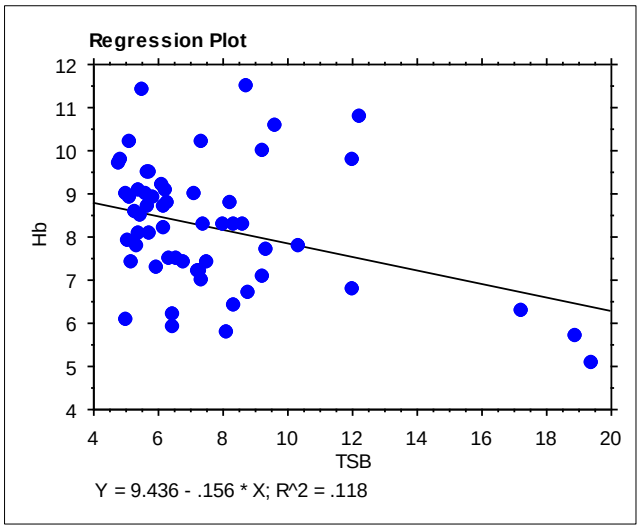

Figure 11: Relationship between TSP and Hb in thalassaemic patients

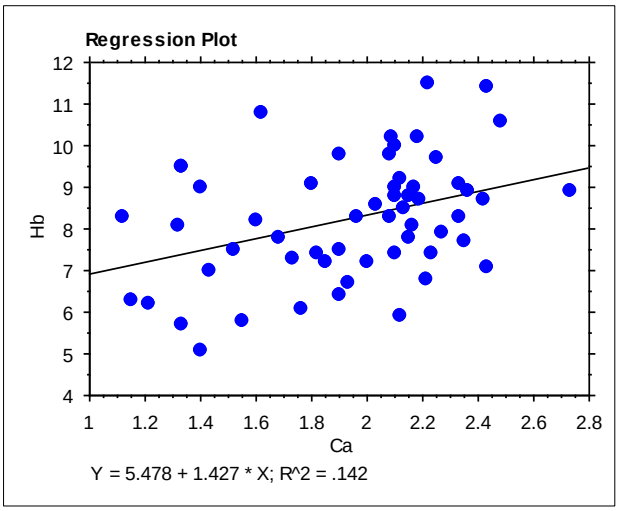

Figure 12: Relationship between Ca and Hb in thalassemia patients

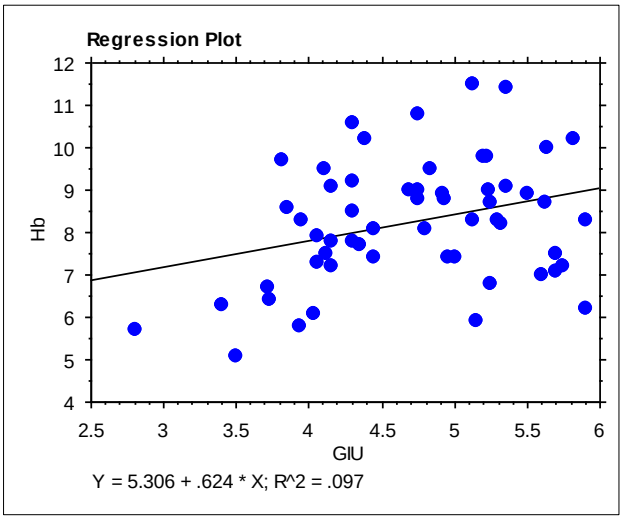

Figure 13: Relationship between GlU and Hb in thalassemia patients

DISCUSSION

Thalassemia is genetic illnesses defined by aberrant hemoglobin production, which is associated with low hemoglobin levels and excessive red blood cell destruction [16]. Over the years, hyper-transfusion has increased the life expectancy of thalassaemic patients; nonetheless, iron overload is an unavoidable complication of thalassemia major caused by an excessive number of blood transfusions. It is so frequent that it is often referred to as a "second disease" while the first is being treated [17].

Since thalassemia is a single-gene disease that is transmitted by a recessive mode of inheritance, the number of affected females (54) in the current study was slightly higher than the number of affected males (52) in that research, which is comparable to what was discovered in Mohammad and Al-Doski's [18] study in Mosel City. Nevertheless, the reported distinction between the current studies is not significant and deserves further investigation. The greater proportion of Thalassaemic female participants in this study may help to explain why it appears that men at the Thalassaemic Center in Baghdad were more cooperative with the therapy than women. Low Hb levels in Thalassaemic patients are expected as β-thalassemia major is a genetic condition that causes severe anemia [19].

This outcome was consistent with earlier investigations [20, 21]. Serum Iron values published by numerous research done in impoverished countries reveal approximately the same as or even greater than the study's reported mean level [22, 23]. Patients with β-Thalassaemia major in our region had significantly higher serum iron levels compared to those in developed nations [24]. When associated with iron levels, the serum activity of the liver enzymes in GOT and AIP in Thalassaemic individuals showed a substantial increase in the current study. Numerous investigations came to the conclusion that elevated blood ferritin levels are linked to cirrhosis of the liver [25]. Concurrently, with these abnormally high liver enzyme levels, there was a significant rise in T.S.B. in patients with Thalassemia when iron levels were considered.

Enzyme leakage into the bloodstream is caused by damage to the liver cells. Moreover, elevations in ALT and bilirubin are often employed in order to determine whether the liver has sustained damage and is impaired in function [26]. Hepatotropic diseases or hepatic siderosis are the causes of liver disease in Thalassaemic patients who receive chronic blood transfusions; these factors can work alone or in combination to induce chronic liver disease by inducing harm to cells via similar oxidative mechanisms [27]. It becomes clear from the current study that iron excess has a role in liver impairment in Thalassaemic patients. This conclusion was consistent with a study conducted in Northern Iran [28], implying that rising iron overload affects or deteriorates liver function in Thalassaemic individuals, as seen by high ALT.

CONCLUSIONS

The present study highlights the significant role of iron overload in causing liver impairment among Thalassaemic patients. Elevated iron levels are shown to adversely affect liver function, as indicated by the increased levels of ALT (alanine aminotransferase), a marker for liver damage. This suggests that excess iron accumulation contributes to the deterioration of liver health in individuals with Thalassaemia.

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