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Original Research Article

Evaluation of Haematological and Biochemical Parameters between HCV Infected and Non-Infected Multitransfused Thalassaemic Patients

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Abstract: ***Background:*** Thalassaemias are inherited disorders of hemoglobin synthesis, with β-thalassaemia being the most prevalent and clinically significant. In Bangladesh, the burden is high, with over 7000 affected births annually and notable carrier rates of both β-thalassaemia and Hb E, especially among tribal populations. The disease arises from β-globin gene mutations, leading to imbalanced globin chain production and severe anemia. Regular transfusions are essential but pose risks, including iron overload and transfusion-transmitted infections like hepatitis C virus (HCV). HCV affects over 60% of transfusion-dependent patients, significantly increasing morbidity and mortality, yet long-term survival data and treatment outcomes remain inadequately explored. ***Aim of the study:*** This study aims to compare the hematological and biochemical parameters of HCV-infected and non-infected multi-transfused thalassaemic patients. ***Methods:*** This cross-sectional observational study was conducted over seven months (February–August 2015) at the Department of Paediatric Haematology and Oncology, Dhaka Shishu Hospital, Bangladesh. Sixty β-thalassemia major patients aged 4–18 years receiving regular transfusions were enrolled, including 11 anti-HCV seropositive and 49 seronegative cases. Participants were recruited from the thalassemia clinic and transfusion unit. Data were collected through interviews, clinical exams, and structured checklists. Laboratory investigations included ELISA for anti-HCV, hematological and biochemical analyses, and hepatic ultrasonography. Statistical analysis was performed using SPSS v16.0 with Chi-square and Student's t-tests; $p < 0.05$ was considered statistically significant. ***Result:*** HCV-positive patients had a significantly higher mean age (11.6±3.8 vs. 9.3±4.6 years; p=0.032) and body weight (24.6±8.8 vs. 15.8±5.5 kg; p=0.001) than HCV-negative patients. Jaundice (p=0.043), abdominal pain (p=0.008), hepatomegaly (p=0.011), and splenomegaly (p=0.035) were significantly more prevalent in the HCV-positive group. Splenomegaly and hepatomegaly sizes were also larger. No significant differences were found in sex, socioeconomic status, hemoglobin, HBsAg status, or most hematological and biochemical markers. However, serum bilirubin was significantly elevated in HCV-positive

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patients (2.2±0.5 vs. 1.5±1.1 mg/dL; p=0.044), indicating greater hepatic involvement. These findings suggest a higher disease burden among HCV-infected individuals. ***Conclusion:*** HCV infection in multi-transfused thalassaemic patients is linked to greater liver involvement, including jaundice, hepatomegaly, and elevated bilirubin. Older age suggests cumulative transfusion risk. Despite similar hemoglobin levels, liver disease burden is higher in HCV-positive individuals, highlighting the need for early screening, safer transfusions, and targeted liver monitoring.

Keywords: Evaluation, Haematological Parameters, Biochemical Parameters, HCV Infection, and Multitransfused Thalassaemia.

INTRODUCTION

Thalassaemias are a group of inherited hemoglobin (Hb) synthesis disorders characterized by the partial or complete absence of one or more globin chains. Among these, β-thalassaemia is particularly prevalent and clinically diverse, ranging from asymptomatic carriers to life-threatening anemia requiring regular blood transfusions [1]. Despite being historically labeled "Mediterranean anemia," thalassaemia is now recognized as a global health concern affecting populations across Asia, Africa, and beyond. According to the World Health Organization (WHO), approximately 6.5% of the world's population carries a hemoglobin disorder, with 3% identified as carriers of transfusion-dependent thalassaemia and 4% as carriers of Hb E in Bangladesh alone [2]. In Bangladesh, the burden of thalassaemia is notably high, with over 7000 children born with the condition annually [3]. The prevalence of the β-thalassaemia trait among Bengali and tribal school children in Bangladesh is approximately 4.1% and 4.2%, respectively [4]. Comparable data from neighboring and regional countries show similar patterns 5% in Pakistan, 3.3% in India, and 3.1% in Tunisia [5-7]. In addition to β-thalassaemia, the Hb E trait is prevalent in Southeast Asia. Among Bengali school children, the prevalence of Hb E trait is 6.1%, but this increases dramatically to 41.7% in tribal children [8]. High carrier rates of Hb E are reported across Cambodia (30%), Laos (35%), and Thailand (13%), with a similar trend observed in northeastern India, particularly in Assam and West Bengal [9]. β-thalassaemia results from mutations affecting the β-globin gene, leading to quantitative defects in β-globin synthesis [10,11]. The unbalanced production of α and β-globin chains causes excess free α-globin chains to precipitate in erythroid precursors, leading to intramedullary destruction, ineffective erythropoiesis, and hemolytic anemia [12]. The clinical severity of the disease correlates with the degree of globin chain imbalance. Multitransfused patients with thalassaemia are prone to numerous complications, among which iron overload and transfusion-transmitted infections like hepatitis C virus (HCV) are of particular concern. HCV is a significant cause of morbidity and mortality in these patients, with liver-related complications accounting for up to 4.1% of deaths [13,14]. Studies estimate that over 60% of patients with transfusion-dependent thalassaemia are infected with HCV [15], with about 40% developing severe hepatic iron overload [16]. Although interferon-based therapies have shown some success in treating HCV in thalassaemia patients, they often exacerbate anemia and increase transfusion requirements [17,18]. Despite the rising life expectancy in this group, comprehensive data on survival and the long-term impact of HCV remains limited [19-21]. This study aims to compare the hematological and biochemical parameters of HCV-infected and non-infected multi-transfused thalassaemic patients to evaluate the burden of infection and associated clinical implications.

METHODOLOGY & MATERIALS

This was a cross-sectional observational study conducted at the Department of Paediatric Haematology and Oncology, Dhaka Shishu Hospital, located in Sher-e-Bangla Nagar, Dhaka, Bangladesh. The study was carried out over a period of seven months, from February 2015 to August 2015. A total of 60 diagnosed cases of β-thalassemia major undergoing regular blood transfusions were enrolled. Of these, 11 patients tested seropositive for anti-HCV antibodies (HCV-positive group), and 49 were seronegative (HCV-negative group). Participants were recruited from the hospital's thalassemia clinic and day-care transfusion unit.

Inclusion Criteria

- Diagnosed case of β-thalassemia major.
- Aged between 4 and 18 years.
- History of multiple blood transfusions.
- Seropositive for anti-HCV antibodies.

Exclusion Criteria

- Known anti-HCV positivity prior to initiation of transfusion therapy.
- Born to a mother positive for anti-HCV antibodies.

- History of intravenous drug abuse involving shared syringes.
- Presence of pre-existing liver disease or hepatitis.
- Refusal to participate or lack of consent.

Data Collection Procedure:

After verifying eligibility criteria, each participant was assigned a unique identification number. Informed consent was obtained from the parents or legal guardians following a detailed explanation of the study's purpose and procedures. Data were collected using a structured checklist through interviews and clinical examination. Demographic details, clinical history, physical findings, and laboratory investigations were recorded.

Laboratory Investigations:

Venous blood samples were collected under strict aseptic conditions for comprehensive laboratory evaluation. Serological tests included detection of anti-HCV antibodies using the ELISA method (ETI-AB-HCVK-4, DiaSorin, Italy) and screening for hepatitis B surface antigen (HBsAg). Hematological assessments comprised hemoglobin concentration (Hb%), total leukocyte count (TLC), and platelet count. Biochemical analyses included serum bilirubin, serum glutamate pyruvate transaminase (SGPT), serum albumin, and prothrombin time (PT). In addition, ultrasonography (USG) of the hepatic-biliary system was performed to assess liver morphology and any structural abnormalities. All serological and biochemical investigations were carried out in the Department of Pathology at Dhaka Shishu Hospital.

Statistical analysis:

Statistical analysis was conducted using SPSS version 16.0 (SPSS Inc., Chicago, IL, USA). Continuous variables were presented as mean ± standard deviation (SD), while categorical variables were summarized using frequencies and percentages. Comparisons between categorical variables were made using the Chi-square test with Yates' correction, and differences in means of continuous variables were assessed using Student's t-test. A p-value of less than 0.05 was considered statistically significant throughout the analysis.

RESULT

According to Table 1, HCV-positive patients had a significantly higher mean age (11.6±3.8 years) compared to HCV-negative patients (9.3±4.6 years), with a p-value of 0.032, suggesting that older patients may be more susceptible to acquiring HCV over time. However, no significant differences were found in sex distribution (p=0.864) or socioeconomic status (p=0.895). Table 2 highlights clinical symptoms, where jaundice was significantly more prevalent in the HCV-positive group (90.91%) than in the HCV-negative group (59.18%) with p=0.043. Similarly, abdominal pain (54.55% vs. 14.29%, p=0.008), hepatomegaly (81.82% vs. 36.73%, p=0.011), and splenomegaly (63.64% vs. 30.61%, p=0.035) were all significantly more common among HCV-infected individuals. Other symptoms like nausea, vomiting, and consanguinity showed no significant differences. Table 3 compares hemoglobin levels. No significant differences were observed between HCV-positive and—negative groups (p=0.970), with most patients in both groups having Hb levels in the 6–10 g/dL range. Table 4 supports earlier findings with quantitative measurements: HCV-positive patients had significantly higher average body weight (24.6±8.8 kg) than HCV-negative patients (15.8±5.5 kg), p=0.001. The mean size of splenomegaly (13.9±2.7 cm vs. 9.6±5.2 cm, p=0.010) and hepatomegaly (12.9±2.9 cm vs. 9.6±5.2 cm, p=0.035) were also significantly larger in the HCV-infected group, indicating a more pronounced disease burden. Table 5 shows HBsAg seropositivity was not significantly different between groups (p=0.434), with no cases in the HCV-positive group and four (8.16%) in the HCV-negative group, suggesting limited HBV co-infection in this population. Finally, Table 6 presents haematological and biochemical comparisons. While total count (TC), platelet count, SGPT, prothrombin time, and serum albumin levels showed no significant differences, the mean serum bilirubin level was significantly higher in the HCV-positive group (2.2±0.5 mg/dL vs. 1.5±1.1 mg/dL; p=0.044), indicating a higher level of liver dysfunction in infected patients.

Table 1: Demographic Characteristics of HCV-Positive and HCV-Negative Multitransfused Thalassaemic Patients

Variables	Positive (n=11)		Negative (n=49)		P value
	n	%	n	%	
Age (in years)					
≤5	2	18.18	12	24.49	0.032s
6–10	3	27.27	18	36.73	
11–16	6	54.55	19	38.78	
Mean ± SD	11.6 ± 3.8		9.3 ± 4.6		

Sex					
Male	6	54.55	28	57.14	0.864ns
Female	5	45.45	21	42.86	
Socioeconomic class					
Poor	7	63.64	30	61.22	0.895ns
Middle class	3	27.27	15	30.61	
Rich	1	9.09	4	8.16	

Table 2: Comparison of Clinical Features between HCV-Positive and HCV-Negative Multitransfused Thalassaemic Patients

Clinical Features	Positive (n=11)		Negative (n=49)		P value
	n	%	n	%	
Jaundice	10	90.91	29	59.18	0.043s
Consanguinity	5	45.45	15	30.61	0.272ns
Abdominal pain	6	54.55	7	14.29	0.008s
Nausea	2	18.18	6	12.24	0.545ns
Vomiting	1	9.09	1	2.04	0.335ns
Immunization	11	100.00	49	100.00	-
Hepatomegaly	9	81.82	18	36.73	0.011s
Splenectomy	2	18.18	6	12.24	0.612ns
Mild hepatomegaly	1	9.09	6	12.24	0.749ns
Mild splenomegaly	2	18.18	8	16.33	0.892ns
Splenomegaly	7	63.64	15	30.61	0.035s
Normal	1	9.09	12	24.49	0.215ns

Table 3: Distribution of Hemoglobin Levels among HCV-Positive and HCV-Negative Multitransfused Thalassaemic Patients

Hb% (gm/dl)	Positive (n=11)		Negative (n=49)		P value
	n	%	n	%	
<5	1	9.09	5	10.20	0.970ns
6–10	9	81.82	41	83.67	
>10	1	9.09	3	6.12	

Table 4: Comparison of History and Physical Examination Findings between HCV-Positive and HCV-Negative Patients

Variables	Positive (n=11)		Negative (n=49)		P value
	n	%	n	%	
	Mean ± SD		Mean ± SD		
Immunization	11	100.00	49	100.00	-
Jaundice	10	90.91	29	59.18	a0.043s
Consanguinity	5	45.45	15	30.61	a0.272ns
Abdominal pain	6	54.55	7	14.29	a0.008s
Nausea	2	18.18	6	12.24	a0.545ns
Vomiting	1	9.09	1	2.04	a0.335ns
Weight (kg)	24.6 ± 8.8		15.8 ± 5.5		b0.001s
Splenomegaly (cm)	13.9 ± 2.7		9.6 ± 5.2		b0.010s
Hepatomegaly (cm)	12.9 ± 2.9		9.6 ± 5.2		b0.035s

Table 5: HBsAg Seropositivity among HCV-Positive and HCV-Negative Multitransfused Thalassaemic Patients

HBsAg	Positive (n=11)		Negative (n=49)		P value
	n	%	n	%	
Positive	0	0.00	4	8.16	0.434ns
Negative	11	100.00	45	91.84	

Table 6: Comparison of Haematological and Biochemical Parameters between HCV-Positive and HCV-Negative Patients

Investigation	Positive (n=11)	Negative (n=49)	P value
	Mean±SD	Mean±SD	
TC (cumm)	9118.2±6497.4	12167.8±14464.1	0.498[ns]
Platelet count (cumm)	294363.6±98917.4	262111.1±158903.8	0.522[ns]
S.Bilirubin (mg/dl)	2.2±0.5	1.5±1.1	0.044[s]
SGPT (U/L)	88.2±82.4	67.1±26.8	0.137[ns]
Prothrombin time (sec)	12.9±3.9	13.5±2.6	0.912[ns]
S.Albumin (gm/L)	43.3±16.2	50.4±62.8	0.712[ns]

DISCUSSION

This study highlights critical differences in haematological and biochemical parameters between HCV-infected and non-infected multi-transfused thalassaemic patients, offering insights into the impact of HCV on this vulnerable population. The findings emphasize the significant clinical burden of HCV infection in patients with thalassaemia, particularly concerning hepatic complications and disease severity. The observation of a significantly higher mean age among HCV-positive patients (11.6±3.8 years) compared to HCV-negative ones (9.3±4.6 years) aligns with previous studies that suggest cumulative exposure to blood transfusions increases the risk of HCV acquisition over time [22,23]. This age-related trend reinforces the importance of early and rigorous screening for HCV in thalassaemic patients undergoing regular transfusions, as increased age may serve as a proxy for higher transfusion exposure and, consequently, higher infection risk. The clinical symptomatology observed in the HCV-infected group further highlights the burden of chronic liver disease. Jaundice, hepatomegaly, and splenomegaly were all significantly more prevalent among HCV-positive patients, consistent with studies that document hepatic dysfunction as a hallmark of chronic HCV infection [24,25]. These symptoms may reflect underlying hepatocellular injury and portal hypertension, both of which are well-recognized sequelae of chronic viral hepatitis [26]. Abdominal pain was also significantly more frequent in the HCV-infected group, potentially due to hepatic capsular stretching or splenic congestion. Interestingly, although HCV infection is associated with hepatic dysfunction, no significant differences in haemoglobin levels were observed between the groups. Both cohorts largely fell within the 6–10 g/dL range, highlighting that the anaemia typical of thalassaemia is mainly independent of HCV status. This finding supports earlier research indicating that HCV does not significantly affect erythropoiesis or haemolysis in thalassaemic patients [27,28]. Quantitative clinical measures reinforced the symptomatic findings: HCV-positive patients exhibited significantly higher body weight and greater degrees of hepatomegaly and splenomegaly. These differences suggest more advanced disease stages or chronic inflammation. Enlarged liver and spleen sizes are indicators of increased reticuloendothelial activity and extramedullary hematopoiesis, which can be exacerbated by chronic liver disease [29]. The increased body weight, though seemingly counterintuitive, may be a result of fluid retention related to hepatic dysfunction or could reflect older age rather than a direct impact of HCV. Serological findings revealed no significant difference in HBsAg seropositivity between the two groups, with zero cases in the HCV-positive cohort. This is encouraging and may reflect effective HBV vaccination programs among this population [30]. This study's absence of HBV-HCV co-infection contrasts with earlier findings from resource-limited settings, where dual infections were more common due to inadequate blood screening. Biochemically, while several parameters such as total count, platelet count, SGPT, and prothrombin time did not differ significantly, serum bilirubin levels were notably higher in the HCV-positive group. Elevated bilirubin is a marker of impaired hepatic excretion and cholestasis, commonly seen in chronic hepatitis C infection [31]. This finding is consistent with the clinical picture of jaundice and supports the conclusion that liver function is more compromised in the HCV-infected thalassaemic population.

Limitations of the study

This study was limited by its cross-sectional design, which restricts the ability to infer causal relationships between HCV infection and the observed haematological or biochemical changes. The sample size was relatively small, potentially affecting the statistical power and generalizability of findings. Additionally, liver imaging and histopathological assessments were not performed, which could have provided more profound insights into hepatic damage. The study also relied on medical records and self-reported symptoms, introducing the risk of recall and documentation bias. Furthermore, the lack of longitudinal follow-up prevents evaluation of disease progression and the long-term impact of HCV infection in thalassaemic patients.

CONCLUSION AND RECOMMENDATIONS

This study demonstrates that HCV infection in multi-transfused thalassaemic patients is associated with significantly greater hepatic involvement, including elevated serum bilirubin levels and increased prevalence of jaundice, hepatomegaly, and splenomegaly. Older age among HCV-positive patients suggests cumulative transfusion exposure as a risk factor. Despite comparable hemoglobin levels across groups, the pronounced clinical and biochemical differences highlight the burden of chronic liver disease in HCV-infected individuals. These findings underscore the need for early HCV screening, stringent blood safety protocols, and targeted monitoring of liver function in thalassaemic populations to reduce morbidity and improve long-term outcomes.

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