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Original Research

Frequency of Hepatitis C Infection in Children with B-Thalassemia Major

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Abstract: **Background:** β- thalassemia major, a transfusion dependent hereditary hemoglobin disorder predisposing affected children to transfusion-transmitted infections especially hepatitis C virus (HCV) Inspite of better blood screening practices, HCV infection has been a major concern in developing countries, including Pakistan. This study was designed to find out the frequency of hepatitis C infection among children with beta-thalassemia major who received multiple blood transfusions. **Methods:** This cross-sectional study was performed during May 30, 2025 to October 29, 2025 at the department of paediatric medicine Sir Ganga Ram Hospital, Lahore. A total of 138 children between 3-13 years of age with transfusion dependent b-THMs were enrolled. Anti-HCV antibody was tested by third-generation enzyme linked immunosorbent assay (ELISA) and positive was confirmed by polymerase chain reaction (PCR). Data were analysed using the (SPSS) version 27.0. Chi-square test was used, $p < 0.05$ to be considered significant; **Results:** The mean age of participants were 8.01 ± 3.56 years, and 58.7% were male. Hepatitis C infection was detected in 43 (31.2%) children. **Conclusion:** A high frequency of hepatitis C infection was seen among children with beta-thalassemia major, especially in children with longer duration of beta-thalassemia major and low socio-economic status. Strengthening transfusion screening and preventive strategies is important to lessen disease burden.

Keywords: β-Thalassemia Major, Hepatitis C, Blood Transfusion, Children, Frequency, Pakistan.

INTRODUCTION

β- Thalassemia major is a severe hereditary haemoglobin disorder caused by mutation of the b-globin gene with the results of ineffective erythropoiesis, severe anaemia, and life-long reliance on regular blood transfusion starting in early childhood.1 Worldwide, hemoglobinopathies are one of the most common monogenic disorders with about 60,000 affected births annually, and a significant concentration in the Mediterranean region, Middle East and South Asia.2 Pakistan is in a thalassemia belt with the estimated carrier rate of 5-7%, and thousands of affected births each year constituting a major public health challenge in paediatric population.3

Hepatitis C virus (HCV) infection is a major cause of chronic liver disease worldwide, affecting an estimated 58 million individuals, with ongoing transmission leading to new infections each year.4 Although the prevalence in children is lower than that in adults, infection in children is of clinical significance as the majority of infected children will develop chronic infection with possible long-term hepatic sequelae.5 Pakistan has one of the highest HCV burdens worldwide and prevalence estimates range between 4-8% on national level therefore it carries significant public health implications, especially in susceptible children groups.6

Children with beta-thalassemia major are more prone to HCV infection because of repeated exposure to blood transfusions, especially in countries where optimal donor screening and testing for nucleic acids are not routinely performed.7 To investigate this phenomenon, studies conducted in developing countries have reported significantly higher HCV

prevalence among multi-transfused thalassemic children which in some instances exceeds that of the general pediatric population.8 Chronic HCV infection in these patients can lead to more rapid hepatic fibrosis due to synergism of the effects of excess iron and liver injury contributed by viral infections with the risk of turning into cirrhosis and hepatocellular carcinoma.9 In spite of improvements in transfusion safety, HCV remains one of the most common transfusion-transmitted infections among children with transfusion-dependent thalassemia in high-burden countries.10

Given the high prevalence of beta-thalassemia major and high national burden of HCV infection in Pakistan, it is important to know the frequency of hepatitis C infection in transfusion-dependent children. Local epidemiological data is needed to measure the success of blood screening programmes, pinpoint gaps in transfusion safety and define preventive strategies. Establishing the magnitude of this problem will help to inform healthcare policies with a goal to reduce transfusion-transmitted infections and improve the long-term outcomes in this vulnerable pediatric population.

MATERIALS AND METHODS

This Study was a cross-sectional study and was performed at the department of pediatric medicine as Sir Ganga Ram Hospital Lahore between May 30, 2025 and October 29, 2025 following approval from the institutional ethical review committee. The sample size of 138 patients was calculated at 95% confidence level, 8% margin of error with anticipated frequency of hepatitis C virus (HCV) infection of 31.7% in patients with b-thalassemia major based on previously reported data.[11] A non-probability consecutive sampling technique was employed for participant recruitment.

Children of both sexes (3-13 years) diagnosed with beta-thalassemia major according to the operational criteria and transfusion dependent (transfusion of blood two to three times per month) were recruited. Patients were excluded if they had pre-existing hepatic disease (ALT or AST levels >45 U/L), pre-existing renal disease (serum creatinine >1 mg/dL), thrombocytopenia (platelet count <100,000/mm^3), neutropenia (polymorphonuclear leukocyte count <1,500/mm^3), very severe anemia (hemoglobin <5 g/dL) or evidence of bone marrow suppression, known hypersensitivity to hydroxyurea or current treatment with chemotherapy or radiotherapy.

Writing informed consent obtained from parents or legal guardians, eligible patients were enrolled consecutively until the required sample size was attained. Demographic information such as age and gender was recorded on a structured predesigned proforma. An approximately 3-5 mL of venous blood was collected under aseptic condition and was collected in sterile serum bottles. Samples were examined at the hospital laboratory for identification of anti-HCV antibodies in a third generation enzyme linked immunosorbent assay (ELISA). All samples which tested positive in anti-HCV antibodies were submitted for confirmatory polymerase chain reaction (PCR) testing for detection of HCV RNA.

Data was transcribed and analysed with Statistical Package for the Social Sciences (SPSS) version 27.0. Qualitative variables, such as gender, socio-economic status and HCV infection status, were summarised as frequencies and percentages. Quantitative variables including age and time of illness were represented as mean+-SD. Stratification was done for age, gender, socio-economic status, and duration of illness to control for possible effect modifiers. Post stratification the Chi-square was used to identify the associations between categorical variables. A p-value <0.05 was regarded as statistically significant.

RESULT

A total of 138 children with β-thalassemia major were included in the study. Among them, 81 (58.7%) were males and 57 (41.3%) were females, showing a male predominance. Regarding age distribution, 45 (32.6%) children were aged 3–5 years, 47 (34.1%) were between 6–10 years, and 46 (33.3%) were between 11–13 years. The mean age of the participants was 8.01±3.56 years.

With respect to socio-economic status, the majority of patients, 84 (60.9%), belonged to the low socio-economic group, followed by 51 (37.0%) from the middle socio-economic group, while only 3 (2.1%) were from the high socio-economic class. Regarding duration of illness, 93 (67.4%) children had illness duration of less than 24 months, whereas 45 (32.6%) had illness duration of 24 months or more. The mean duration of illness was 21.74 ± 4.37 months. Hepatitis C infection was detected in 43 (31.2%) children, while 95 (68.8%) were negative for hepatitis C virus infection.

Table-2 shows the stratification of hepatitis C infection with respect to gender, age groups, socio-economic status, and duration of illness. Hepatitis C showed no significant association with gender ($p = 0.114$) or age group ($p = 0.218$). However, a significant association was observed with socio-economic status ($p = 0.011$) and duration of illness ($p = 0.001$), with higher HCV positivity among children from low socio-economic status and those with illness duration ≥24 months.

Table-1: Frequency distribution of different variables (n=138)

Variables		Frequency	Percent
Gender	**Male**	**81**	**58.7%**
	Female	**57**	**41.3%**
Age groups	3-5 years	45	32.6%
	6-10 years	47	34.1%
	11-13 years	46	33.3%
	Mean age (years)	8.01±3.56	
Socio-economic status	Low	84	60.9%
	Middle	51	37.0%
	High	3	2.1%
Duration of illness	<24 months	93	67.4%
	≥24 months	45	32.6%
	Mean duration of illness (months)	21.74±4.37	
Hepatitis C	Yes	43	31.2%
	No	95	68.8%

Table-2: Stratification of hepatitis C with respect to different variables

Variables		Hepatitis C		p-value
		Yes	No	
Gender	Male	21(25.9%)	60(74.1%)	0.114
	Female	22(38.6%)	35(61.4%)	
Age groups	3-5 years	10(22.2%)	35(77.8%)	0.218
	6-10 years	15(31.9%)	32(68.1%)	
	11-13 years	18(39.1%)	28(60.9%)	
Socio-economic status	Low	34(40.5%)	50(59.5%)	0.011
	Middle	9(17.6%)	42(82.4%)	
	High	0(0.0%)	3(100.0%)	
Duration of illness	<24 months	17(18.3%)	76(81.7%)	0.001
	≥24 months	26(57.8%)	19(42.2%)	

DISCUSSION

In the present study the prevalence of hepatitis C virus (HCV) infection among children with beta-thalassemia major was 31.2%. This figure is still of concern despite an improvement in the protocols for blood screening. Recent regional and international data have shown variable but persistently high HCV rates in transfusion-dependent patients with thalassemia.

A Pakistani study found that HCV prevalence in b-thalassemia major patients was 25.7%, while a systematic review in 2022 found a higher prevalence of HCV frequency 34.7%.[12 - 13] Likewise, a study in India found HCV seropositivity in 30.5% of transfusion-dependent children.[14] These results are similar to ours indicating that HCV remains a significant burden in thalassemia populations.

Internationally, prevalence rates differ depending on the screening strategies and healthcare infrastructure. An Indian study published in 2024 found HCV infection in 32.1% of the multi-transfused thalassemia patients which is close to our result. A higher prevalence of 44.0% was documented by a study from Egypt in 2024 which may reflect differences in transfusion safety measures.[15-16]

Conversely, lower rates have been reported in countries where the rate of nucleic acid testing (NAT) has been implemented; for instance, a 2021 study in Iraq reported 18.6% prevalence, and data from a cohort study in Turkey (2023) showed only 12.4% HCV positivity.[17-18] Such disparity is likely due to differences in blood donor screening practises, NAT implementation and infection control measures.

Our study also showed the significant association between longer duration of illness (24 months) and HCV positivity (57.8% vs. 18.3%, p=0.001), consistent with the findings of a study in Bangladesh, showing persistence of HCV infection (52.0% HCV positivity) among patients transfused for >18 months.[19]

Similarly, low HCV rates (3.1%) were recorded in a 2023 study in Yemen in patients with transfusion dependent.[20] Another finding in our study is an association between low socio-economic status and HCV infection (40.5%, p=0.011), with a 2025 study in amongst excentre centers on socio-economic deprivation, which found association of low socio-economic deprivation as an independent predictor for

transfusion-transmitted infections.[21]

Despite improved screening of donors, continuous HCV-associated infection among beta-thalassemia major patient's highlights lags in transfusion safety and early antiviral therapy. The prevalence observed in our study (31.2%) translates to an intermediate-to-high burden when compared with both regional and international data and raises awareness necessary for the continued vulnerability of multi-transfused children in resource-limited settings.

This study was done in a single tertiary care centre with a relatively small sample size, which may have limited generalizability. In addition, no viral load quantification or genotype analysis was performed and risk factors, such as number of transfusions, were not analyzed in detail.

CONCLUSION

A high frequency of hepatitis C virus infection was seen among children with beta-thalassemia major, specifically among those children with longer duration of illness and low socio-economic status. Strengthening transfusion screening and prevention approaches is necessary to lessen the burden of disease.

BIBLIOGRAPHY

1. Kattamis A, Kwiatkowski JL, Aydinok Y. Thalassaemia. The lancet. 2022;399(10343):2310-24. DOI: 10.1016/S0140-6736(22)00536-0
2. Lippi G, Mattiuzzi C. Updated worldwide epidemiology of inherited hemoglobin disorders. Acta haematologica. 2020;143(3):196-203. DOI: https://doi.org/10.1159/000502434
3. Haq EU, Naeem A, Awan UA, Khan SN, Zohaib M, Uddin G. High prevalence and molecular spectrum of β-thalassemia trait in Haripur and Abbottabad districts of Pakistan: implications for regional carrier screening programs. Egyptian Journal of Medical Human Genetics. 2025;26(1):167-72. DOI: https://doi.org/10.1186/s43042-025-00795-4
4. Beard N, Hill A. Combined "test and treat" campaigns for human immunodeficiency virus, hepatitis B, and hepatitis C: a systematic review to provide evidence to support world health organization treatment guidelines. InOpen Forum Infectious Diseases. 2024;11(2):666-72. DOI: https://doi.org/10.1093/ofid/ofad666
5. Indolfi G, Gonzalez-Peralta RP, Jonas MM, Sayed MH, Fischler B, Sokal E, et al. ESPGHAN recommendations on treatment of chronic hepatitis C virus infection in adolescents and children including those living in resource-limited settings. Journal of Pediatric Gastroenterology and Nutrition. 2024;78(4):957-72. DOI: https://doi.org/10.1002/jpn3.12160
6. Saleem U, Aslam N, Siddique R, Iqbal S, Manan M. Hepatitis C virus: Its prevalence, risk factors and genotype distribution in Pakistan. European Journal of Inflammation. 2022;20:1721727X221144391. DOI: https://doi.org/10.1177/1721727X221144391
7. Ghafoor MB, Memon FA, Saleem M, Shabbir R. Transfusion Transmitted Infections in Multiple Transfused Thalassemia Patients in Rahim Yar Khan. Journal of Liaquat University of Medical & Health Sciences. 2021;20(1):31-6. DOI: http://ojs.lumhs.edu.pk/index.php/jlumhs/article/view/605
8. Farshadpour F, Taherkhani R. Prevalence and molecular evaluation of hepatitis C virus infection among multi-transfused thalassemia patients in south of Iran. Oman Medical Journal. 2022;37(5):427-32. DOI: 10.5001/omj.2022.85
9. Baghersalimi A, Darbandi B, Leyli EK, Mavardiani ZK, Sharbafi MA, Balesbaneh AR. Evaluation of self-efficacy in children and adolescents with thalassemia major. Journal of Pediatric Hematology/Oncology. 2021;43(6):754-8. DOI: 10.1097/MPH.0000000000002219
10. Altaf W, Hussain M. Frequency of Hepatitis B Virus and Hepatitis C Virus Infection in Beta Thalassemia Major Children in Tertiary Care Hospital. Indus Journal of Bioscience Research. 2025;3(1):444-8. DOI: https://doi.org/10.70749/ijbr.v3i1.490
11. Nadir R, Anjum A, Ijaz SF. Frequency of hepatitis B and C in beta thalassemia major with multiple blood transfusions. Pak J Med Health Sci. 2020;14(4):764–5. DOI: http://pjmhsonline.com/published-issues/2020-issues/oct-dec-2020/20-12-764
12. Khan SA, Irshad M. Frequency of hepatitis B, hepatitis C, and HIV in blood transfusion dependent thalassemia patients in a tertiary care hospital. Biol Clin Sci Res J. 2025;6(6):206–9. DOI: https://doi.org/10.54112/bcsrj.v6i6.1862
13. Riaz M, Abbas M, Rasool G, Baig IS, Mahmood Z, Munir N, et al. Prevalence of transfusion-transmitted infections in multiple blood transfusion-dependent thalassemic patients in Asia: A systemic review. International Journal of Immunopathology and Pharmacology. 2022; 36:03946320221096909. DOI: 10.1177/03946320221096909
14. Biswas B, Naskar NN, Basu K, Dasgupta A, Basu R, Paul B. Transfusion-transmitted infections, its risk factors and impact on quality of life: An epidemiological study among β-thalassemia major children. Asian Journal of Transfusion Science. 2022;16(1):99-105. DOI: 10.4103/ajts.AJTS_74_18
15. Mandal TK, Sarkar S, Haldar P, Mondal S, Chatterjee SS, Paul P, et al. Prevalence of HIV, hepatitis B and hepatitis C infections among

patients with thalassemia attending a tertiary care (rural) hospital. Journal of family medicine and primary care. 2024;13(5):1780-6. DOI: 10.4103/jfmpc.jfmpc_1751_23

16. Mostafa E, El Shenawy R, Tabll A, Shoman S. Prevalence of viral hepatitis (A, B, C, and E) infection and co-infection among hospitalized children in Cairo, Egypt. Egypt J Immunol. 2024;31(1):30-9. DOI: https://doi.org/10.55133/eji.310104
17. Aljumaili Z. Hepatitis C Virus Prevalence among Patients with Beta Thalassemia Major in Iraq: A Systematic Review.: HCV in Thalassemia Major. International Journal Of Medical Sciences. 2021;4(3):6-16. DOI: https://orcid.org/0000-0003-1723-1967
18. Şahinoğlu EP, Karakoyun M. Evaluation of Transfusion-Related Infections in Patients with Beta Thalassemia Major in Southeast Turkey: Transfusion-Related Infections in Patients with Beta Thalassemia Major. The Journal of Pediatric Academy. 2023;4(4):135-8. DOI: https://doi.org/10.4274/jpea.2023.244
19. Bhuyan GS, Noor AU, Sultana R, Noor FA, Sultana N, Sarker SK, et al. Frequency of hepatitis B, C and HIV infections among transfusion-dependent beta thalassemia patients in Dhaka. Infectious Disease Reports. 2021;13(1):89-95. DOI: https://doi.org/10.3390/idr13010011
20. Al Awadhy NA. Prevalence of Hepatitis B and C viruses among Thalassemia Patients in Yemen. Thesis. 2023.
21. Anwer R, Siddiq HM, Shahzadi S, Qureshi AM, Safdar A, Zafar S, Ali S. Systematic review of the incidence of transfusion-transmitted infections in thalassemia patients receiving multiple blood transfusions. Insights-Journal of Life and Social Sciences. 2025;3(5):49-56. DOI: https://doi.org/10.71000/89m8sy91

