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Estimation of Blood-Borne Virus Infections in Beta Thalassemia Major Patients

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ABSTRACT

Thalassemia is a heterogeneous inherited anemia caused by mutations affecting globin-chain synthesis in hemoglobin, leading to ineffective erythropoiesis and hemolytic anemia. Patients commonly require lifelong blood transfusions, which increase the risk of transfusion-transmitted infections such as hepatitis B and C, potentially worsening health outcomes. This cross-sectional study aimed to determine the frequency and distribution of hepatitis viruses among thalassemia patients and their association with thalassemia type, transfusion history, splenic status, and sociodemographic factors. The study was conducted at the Hematology Center of Al-Diwaniyah Health Department from February to August 2024 and included 328 patients. Blood samples (3–5 mL) were tested for hepatitis viruses using ELISA, and data were analyzed with SPSS 20. Results showed HCV positivity in 3/328 (0.9%) patients and HBsAg positivity in 1/328 (0.3%), with equal distribution between sexes and higher prevalence in urban areas and the 16–25-year age group. All infected patients received twice-monthly transfusions, most had low educational and income levels, and only one had undergone splenectomy. The study confirms the presence of HBV and HCV infections in multi-transfused thalassemia patients, with infection risk increasing with age and number of transfusions, particularly for HCV.

Keywords: Thalassemia, Hepatitis C Virus, Hepatitis B Virus

INTRODUCTION

Thalassemia is a hematological disorder that caused by mutations in the genes that encode hemoglobin chains, which leads to inefficient erythropoiesis process. Mutations in the βeta-globin genes are the most frequent cause of inherited disorders in humans, with 350 βeta-thalassemia variation identified to date Aziz et. al., (2022). The World Health Organization (WHO) estimated that, worldwide, 40,000 infants yearly are born already with thalassemia illness, and most of this group have βeta-thalassemia form. Most children suffering from thalassemia are born usually in low-and in middle-income countries population Ahmed et. al., (2021). The prevalent of β-thalassemia differs geographically, with higher prevalence existed in specific regions. There is a high rate of βeta-thalassemia in the Mediterranean area (like Greece, Cyprus, and Italy), the Middle East area (e.g. Iran and Iraq,), and some other territories of Asia (e.g. Pakistan, Bangladesh, and India) Rao et.al., (2021).

In Iraq, thalassemia represented 75% of all hemoglobinopathies inherited disorders, Iraq presently calculated total of (13390) reported cases of thalassemia, leading to frequency of (3.4/10000) cases. Abd Hussein et. al., (2024). Two types of thalassemia illnesses are found: alpha and beta-thalassemia form, each of them trigger anemia in different grades, extending from mild to potentially fatal affect Herbert et. al., (2009). Beta-thalassemia illness (β-thalassemia) possess double medically important forms, Beta-thalassemia major intermedia, resulted from lack or decrease synthesis of the hemoglobin subpart beta (beta globin molecule chain) Langer et al, (2000). Patients contacting beta-thalassemia major (BTM) have extreme chronic hemolytic anemia which require continuous blood transfusions start with early childhood. Continuous blood transfusion treatment is usually associated with iron chelating treatment to prevent serious consequences resulted from iron overdose, as in heart-related morbidity, diseases of liver, disorders of endocrine Kattamis et. al. (2020).

Regular blood transfusions regarded as common treatment for BTM to improve health condition and enhance their survival opportunity , but on other hand ,make thalassemia patients more capable to acquire infection with blood-transfer diseases such as hepatitis viruses (Khalil et.al., (2016);Mandal et. al., (2024)). Infections with hepatitis viruses regarded amongst the high eight reasons of fatalities, with around 1.34 million annually fatalities worldwide. It evaluated around 257 million individual are contracting with HBV and 71 million person with hepatitis C virus (HCV) chronically. These diseases known as silent killer due to many of infected patients could stay undetected and non-treated for long time prior to their health consequences getting worse Ahmed et. al., (2021). Post-transfusion viral hepatitis has considerably involved to morbidity in thalassemia patients with elevated risk for progressing of life- threatening issues Mukherjee et. al., (2021). It revealed that the second typical cause of mortality in thalassemia major patients over fifteen years of age was liver disease, due to complications of viral hepatitis Al-Sharifi et. al. (2019). Chronic HBV or HCV infections can affects the liver, people with chronic hepatitis are at high risk of: chronic liver disease, cirrhosis, liver cancer Cropley et. al., (2017). The aim of present study was to calculate the circulating of HBV and HCV in thalassemia patients with regard to age, sex, residency, and other socio-demographic variables in Al-Diwanyah province and to quantify the requirments to perform safe transfusion protocols.

METHOD

Present study is a cross-sectional, performed in the hematology center of Al-Diwanya Health Department, Al-Diwanya governorate,Iraq. Present study extended from February to august 2024.The number of beta thalassemia patients that enrolled into present study was (328) patients. The data which registered for all patient contain age of person,sex, period of the illness, history of family with thalassemia, thalassemia form either major or intermedia, numbers of transfusing, state of spleen, history of family with hepatitis viruses infection if any, and vaccinating records. Approximately 3-5ml of vein blood taken and put in a sera tubes under aseptic procedure and screened into labs of center for Hematology for detection of HBsAg and anti-HCV Antibodies by third generation ELISA. All the data was entered and analyzed in (SPSS) to recognize the relationship between infections and age of patients, sex and frequency of transfusions.

RESULTS AND DISCUSSION

Out of (328) beta thalassemia patients that included in this study only 4/328(1.2%) patients showed positive infection with both of HCV and HBV, the result showed higher positive cases for hepatitis C virus infection 3/328(0.9%) than 1/328(0.3%) patients were hepatitis B virus surface antigen positive with (CI -1.95-1.97) and without significant statistically at value of $p < 0.05$. The current study also shows that the infection rate with hepatitis C and B viruses has increased within the specific age group C-(16-25 years), as shown in table (2). Besides, study also showed that the rate of infection with hepatitis virus into thalassemia patients is equal for both males and females, as shown in Table (3). This study also showed an increase or concentration of hepatitis infections in urban areas rather than rural areas , as shown in table no (4). Also, this study showed all hepatitis infected-patients were receive blood transfusion twice monthly with rate 4/98(29.9%) according to treatment protocol. As below in table no (5). Moreover, for other socio-demographic variables the study showed most of patients had relative low education level, low income, only one infected patient undergone splenectomy,as that shown in table no (6).

Table 1. Distribution of Hepatitis-Thalassemia patients concerning type of virus

Types of viruses	Positive No	Negative No	Positive percentage %	P -value	Confidant interval-CI
HCV	3	325	3/328(0.9%)	0.07	1.95-1.97
HBV	1	327	1/328(0.3%)	0.5	
Total	**4**	**328**	**4/328(1.2%)**	**-**	

Table 2. Distribution of Hepatitis-Thalassemia patients concerning age

Age	Thalassemia positive	Percentage per – age	HBV-positive percentage	HCV-positive percentage
A-≥5	61/328	19%	-	-
B-6-15	148/328	45%	-	-
C-16-25	92/328	28%	1/92(1.1%)	2/92(2%)
D-≤26	27/328	8%	-	1/27(3.7%)
Total	**328**	**100%**	**1/328(0.3%)**	**3/328(0.9%)**

Table 3. Distribution of Hepatitis-Thalassemia patients concerning to sex

Sex	Male	Percentage%	Female	percentage %
HCV	1	1/170(0.6%)	2	1/158(1.3%)
HBV	1	1/170(0.6%)	0	0
Total	**2**	**-**	**2**	**-**

Table 4. Distribution of Hepatitis-Thalassemia patients concerning residency

Residency	Total ratio	Hepatitis virus-Positive cases	Total ratio of positive /negative cases	Percentage
Urban	**103**/328	2	3/103	(2.9%)
HCV		1		
HBV				
Rural	**225**/328	1	1/225	(0.04%)
HCV		0		
HBV				

Table 5. Distribution of Hepatitis-Thalassemia patients concerning transfusion number

Transfusion no.	Ratio	Percentage	Hepatitis patients - transfusion no.	Percentage
1 time	200/328	60%	0	0
2 times	98/328	29.9%	4/98	4%
3 times	24/328	7.3%	0	0
times≤ 4	6/328	1.8%	0	0
total	328	100%	-	-

Table 6. Distribution of Hepatitis-Thalassemia patients concerning socio-demographic variables

Variables	hepatitis- thalassemia patients-ratio	Percentage %
Education		
primary	2/328	0.6%
secondary	2/328	0.6%
graduated	0	-
Employment status-fund		
Employed	1/328	0.3%
Un employed	3/328	0.9%
Marital status		
Single	2/328	0.6%
Married	2/328	0.6%
Past surgery		
Yes	1/328	0.3%
No	3/328	0.9%

Present study shows a relatively noticeable prevalence of hepatitis virus infections among thalassemia patients 4/328 (1.2%), whereas the infection rate with HCV is higher than with HBV, this may be due to the lack of an effective vaccine against hepatitis C virus Ansari et. al., (2012) and May due to the relative higher incidence of this virus within the local community compared to HBV.

Present result with regarded to HCV showed 3/328(0.9%) positive cases into beta thalassemia patients so it was lower than results of (69%) in Dohuk Arwa et. al., (2019), (42.5%) in Basra Najim et. al., (2018), (26.4%) in Diyala Raham et. al., (2011), (10.89%) in Misan Hassan et. al., (2024), (24.2%) in Wasit Muslim (2014), (26%) in Baghdad Ali (2018), (12.1%) in Diyala Al-Zuheiry (2016), (25%) in Babylon Muhsin and Abdul (2013), (37%) in Karbala Al-greti (2013), (15.98%) in Thi-Qar Al Badry (2015). On other side present result revealed (0.3%) positive cases with HBV in thalassemia group, so, it was fewer than (0.47%) in Thi-Qar governorate Othman and Abbas (2020), (22.5%) in Sulaimani province Hama and Sawa (2017). This decreasing frequencies into group of beta thalassemia patient contracting hepatitis infections in Al Diwanyah province in comparable to other Iraqi

governorates may refers to overall decreasing of hepatitis infections in local community, providing of proper medical services and medical surveillance from local health authorities.

With regarded to age, concentration of hepatitis virus infections in specific age groups among thalassemia patients—particularly adolescents and young adults—is the result of cumulative exposure regularly, frequency of transfusions, immune response state, and healthcare and tests evolution over time (Origa (2023); Jang et. al., (2017)). This may be attributed to the fact of both sexes are exposed to the same health risks exposure when undergoing blood transfusions rather than biological differences between them Altaf and Hussain (2025).

According to residency in this study, the reason for the increase in infections with hepatitis viruses in urban areas compared to rural areas may attributed to the relative high population density in those areas and thus the increase in the rate of horizontal transmission of such infections, or due to the increasing migration to cities. It may also be due to the risks of behavior and mishandling of waste or procedures of health facilities, as well as due to the limited access to proper diagnosis in rural areas Reyes et. al., (2012); Anticona et. al., (2015)).

This study also showed that the rate of infection with hepatitis virus was concentrated in patients who received blood transfusions twice a month، unlike the rest of the groups whose rates of blood transfusions ranged from once to more than four times monthly, this may be due to the infection concentration in this category of patients because relatively large numbers, and the increased frequency of blood transfusions they receive on a monthly basis, which exposes them to greater risk of catching infection.

Concerning socio-demographic criteria, this study showed that the level of education among the current group of patients ranged between primary and intermediate, and this level may not provide the patient with the necessary or adequate knowledge to maintain health condition and to avoid contracting viral infections transmitted through the blood Raguphati (2020).

It also note the lack of adequate financial support provided to patients may negatively affect their ability to monitor and improve their health condition properly Okunrintemi et. al., (2019). The study also showed that half of the hepatitis patients in this group were already married, which indicates the risk of transmitting such viral infections to their families. The study also showed that only one patient with HCV had to have his splenectomy to reduce transfusion frequency and so iron overload burden Farmakis et. al., (2022).

CONCLUSION

Despite the relatively low incidence of hepatitis among thalassemia patients in Diwaniyah Governorate compared to other governorates, more efforts are required to prevent the transmission of infection to this group by applying strict standards for blood donation, conducting more advanced and reliable regular tests for transfused blood, applying the best health safety standards for patients , this incorporates using of PCR method along with Elisa to confirm the infections ,raising the cultural level of patients to know methods of avoiding infection, and provide adequate therapy with antiviral medication to decline the incidence and complications of hepatitis infections .

AUTHOR'S CONTRIBUTION

The author played a role in data collection and article preparation.

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REFERENSI

Abd Hussein, T., Tawfeeq, N. A., Hussein, H. G., Mohammed, H. H., Mohammed, W. J., & Ibraheem, D. S. (2024). Distribution of blood groups with β-thalassemia mutations in Iraqi patients. *ISAR J Med Pharm Sci*, 2 (9), 38-44. https://isarpublisher.com/journal/isarjmps

Ahmed, S., Ayub, M., Naeem, M., Nazir, F. H., Hussain, A., Ghilzai, D., Magnius, L. O., Sajjad, A., & Norder, H. (2021). Thalassemia Patients from Baluchistan in Pakistan Are Infected with Multiple Hepatitis B or C Virus Strains. *The American Journal of Tropical Medicine and Hygiene*, 104(4), 1569-1576. Retrieved from https://doi.org/10.4269/ajtmh.20-0740

Ali, Z. H. (2018). Prevalence and risk factors for hepatitis C virus in Beta thalassemic patients attending blood diseases center in Ibn-AL-Baladi Hospital, Baghdad. *Al-Kindy College Medical Journal*, 14(1), 42-49

Altaf, W., & Hussain, M. (2025). Frequency of Hepatitis B Virus and Hepatitis C Virus Infection in Beta Thalassemia Major Children in Tertiary Care Hospital. *Indus Journal of Bioscience Research*, 3(1), 444-448. Doi: 10.70749/ijbr.v3i1.490

Al Badry, BJ. (2025). Epidemiology, mode of transmission and risk factors of hepatitis C virus (HCV) infections in Thi-Qar province, Iraq. *Int J Advan Res*, 3(10), 1025-1032

Al-Greti, S. H. H. (2013). Prevalence of hepatitis C virus in beta-thalassemia major patients at Karbala governorate. *Journal of Babylon University/Pure and applied Sciences*, 21(8), 2801-5. Retrieved from: https://www.researchgate.net/publication/336100071_prevalence_of_hepatitis_c_virus_in_Beta-thalasemia_major_patients_at_Karbala_governorate

Al-Sharifi, Liqaa Mohammed., Murtadha, J., Shahad, A., Mohammed, Y., Sura, J., Waleed, Z., Raheeq, M., Sura, A., Ehab, H., Shahad, M., Abbas, Q. (2019). Prevalence of Hepatitis B and C in Thalassemic Patients and its Relation with Type of Thalassemia, Frequency of Blood Transfusion, and Spleen Status. *Medical Journal of Babylon*, 16(2), 108-111. doi: 10.4103/MJBL.MJBL_6_19

Al-Zuheiry, M. S. (2016). The Prevalence and the Quantification of Hepatitis C Virus among Thalassemia Patients using ELISA and PCR in Diyala Province. *Diyala Journal of Medicine*, 10(2), 63-69.

Ansari SH, Shamsi TS, Khan MT, Perveen K, Farzana T, Erum S, Ansari I. (2012). Seropositivity of Hepatitis C, Hepatitis B and HIV in chronically transfused ββ-thalassaemia major patients. *J Coll Physicians Surg Pak*. 22(9):610-1. Retrieved from: https:pubmed.ncbi.nlm.nih.gov/22980623

Anticona Huaynate, C. F., Pajuelo Travezaño, M. J., Correa, M., Mayta Malpartida, H., Oberhelman, R., Murphy, L. L., & Paz-Soldan, V. A. (2015). Diagnostics barriers and innovations in rural areas: insights from

junior medical doctors on the frontlines of rural care in Peru. *BMC health services research*, 15, 454. Doi: 10.1186/s12913-015-1114-7

Arwa, A. A. and Abdulrhem T. Y. A. (2019). Prevalence of Hepatitis C Virus in Thalassemia and Hemoglobinopathies in Duhok City/Iraq. *Research Journal of Medical Sciences*, 13: 11-15

Aziz, A., Sayed, S., Ismail, D., & Mohamed, Z. (2022). Hematological Parameters in Beta Thalassemia Major Children. *Minia Journal of Medical Research*, 33(2), 167-170. doi: 10.21608/mjmr.2022.255684

Cropley A, and Weltman, M. (2017). The use of immunosuppression in autoimmune hepatitis: A current literature review. Clin mol hepatol, 23(1):22-26. Retrieved from e-cmh.org/journal/view.php?doi=10.3350/cmh.2016.0089

Farmakis, D., Porter, J., Taher, A., Domenica Cappellini, M., Angastiniotis, M., & Eleftheriou, A. (2022). 2021 Thalassaemia International Federation Guidelines for the Management of Transfusion-dependent Thalassemia. *HemaSphere*, 6(8), e732. Doi: 10.1097/HS9.0000000000000732

Hama, S.A., Sawa, M.I. (2017). Prevalence of hepatitis B, C, and D among thalassemia patients in sulaimani governorate. *Kurdistan Journal of Applied Research*, 2(2), 137-42. Doi: 10.24017/science.2017.2.20

Hassan, A., Al-Omary, T., Abbas, S., & Al-hraishawi, H. (2024). Prevalence rate of Hepatitis C virus among B- Thalassemia major patients in Misan, Iraq. *Journal of Bioscience and Applied Research*, 10(6), 15-21. doi: 10.21608/jbaar.2024.394782

Herbert L, Muncie JR, Campbell JS. (2009). Alpha and beta thalassemia. *Am Fam Physician*. 80(4), 339-344. Retrieved from https://www.aafp.org/pubs/afp/issues/2009/0815/p339.html

Jang TY, Lin PC, Huang CI, Liao YM, Yeh ML, et al. (2017) Seroprevalence and clinical characteristics of viral hepatitis in transfusion-dependent thalassemia and hemophilia patients. *PLOS ONE,* 12(6), 1-11, e0178883. Doi: 10.1371/journal.pone.0178883

Kattamis, A., Forni, G. L., Aydinok, Y., & Viprakasit, V. (2020). Changing patterns in the epidemiology of β-thalassemia. *European journal of haematology*, 105(6), 692–703. Doi: doi.org/10.1111/ejh.13512

Khalil S, Khan HS, Akhtar P. (2016). Status of hepatitis B and C in beta thalassemia major patients. *Journal of Islamabad Medical & Dental College (JIMDC)*. 5(2):71-3. Retrieved from https://share.google/XMIWU4eyORtABLCKe

Langer AL. (2000). Beta-Thalassemia. 2000 Sep 28 [Updated 2024 Feb 8]. In: Adam MP, Feldman J, Mirzaa GM, et al., editors. GeneReviews® [Internet]. Seattle (WA): University of Washington, Seattle; 1993-2025. Available from: https://www.ncbi.nlm.nih.gov/books/NBK1426/

Mandal, T. K., Sarkar, S., Haldar, P., Mondal, S., Chatterjee, S. S., Paul, P., Ray, R., Ghosh, R. R., Saha, S., & Dan, U. (2024). 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*, 13(5), 1780–1786. Doi: 10.4103/jfmpc.jfmpc_1751_23

Muhsin, M. A., & Abdul-Husin, I. F. (2013). Seroprevalence of hepatitis B and C among thalassemic, haemophilic patients in Babylon Governorate-Iraq. *Medical Journal of Babylon*, 10(2), 445-454. Retrieved from https://share.google/yoSz7yof5DV1tXD6o

Mukherjee, K., Bhattacharjee, D., & Chakraborti, G. (2017). Prevalence of hepatitis B and hepatitis C virus infection in repeatedly transfused thalassemics in a tertiary care hospital in eastern India. *Int J Res Med Sci*, 5(10), 4558-4562. Doi: 10.18203/2320-6012.ijrms20174596

Muslim, T. M. (2014). Epidemiologic Study of Hepatitis B and C Virus Among Thalassemia Patient in Wassit Governorate/Iraq.Al-Taqani, 27(2), 1-6. Retrieved from https://share.google/scTe7H82PNFt7Dj0R

Najim OA, Hassan MK. (2018). Prevalence of hepatitis C virus seropositivity among multitransfused patients with hereditary anemias in Basra, Iraq. *Iraqi Journal of Hematology*, 7(1), 39-44. Doi: 10.4103/ijh.ijh_41_17

Okunrintemi, V., Khera, R., Spatz, E. S., Salami, J. A., Valero-Elizondo, J., Warraich, H. J., Virani, S. S., Blankstein, R., Blaha, M. J., Pawlik, T. M., Dharmarajan, K., Krumholz, H. M., & Nasir, K. (2019). Association of Income Disparities with Patient-Reported Healthcare Experience. *Journal of general internal medicine*, 34(6), 884–892. Doi: 10.1007/s11606-019-04848-4

Origa, R. (2023). Hepatitis C and Thalassemia: A Story with (Almost) a Happy Ending. *Pathogens*, 12(5), 683. Doi: 10.3390/pathogens12050683.

Othman RA, Abbas YA. (2020)Prevalence of Hepatitis B and C in Thi-Qar Province-Iraq from 2015-2019. *European Journal of Molecular & Clinical Medicine*,7(2),43-8. Retrieved from https://share.google/cP0d2DkP1hE8AaX9I

Reyes, R., Ahn, R., Thurber, K., & Burke, T. F. (2012). Urbanization and Infectious Diseases: General Principles, Historical Perspectives, and Contemporary Challenges. *Challenges in Infectious Diseases*, 123–146. Doi: 10.1007/978-1-4614-4496-1_4

Raghupathi, V., Raghupathi, W. (2020). The influence of education on health: an empirical assessment of OECD countries for the period 1995–2015. *Arch Public Health* 78, 20. Doi: 10.1186/s13690-020-00402-5

Raham TF, Wahed SS, Alhaddad HN. (2011). Prevalence of Hepatitis C among patients with βthalasemia in Diyala-Iraq. *Journal of Techniques*. 24(4), 1-8. Retrieved from https://share.google/IU5swjimRvVGY7Dmr

Rao, E., Chandraker, S. K., Singh, M. M., & Kumar, R. (2024). Global distribution of β-thalassemia mutations: An update. *Gene*, 896, 148022. Doi: 10.1016/j.gene.2023.148022

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