International Journal of Innovative Research in Medical Science (IJIRMS)
Volume 08, Issue 06, June 2023,
https://doi.org/10.23958/ijirms/vol08-i06/1685

Original article

The Prevalence of Transfusion-Transmitted Infections and their Associated Risk Factors among Transfusion-Dependent Beta-Thalassemia Major Patients Registered in a Tertiary Care Hospital in Jamnagar, Gujarat

Alpesh S. Parmar [1], Viral R. Shah [2], Harsh K. Patel [3], Bela A. Patel [*3]

[1]Resident Doctor, Community Medicine Department, Shree M.P. Shah Government Medical College, Jamnagar, Gujarat, India.
[2]Associate Professor, Community Medicine Department, Shree M.P. Shah Government Medical College, Jamnagar, Gujarat, India.
[3]Senior Resident, Community Medicine Department, 3rd Floor, College Building, GMERS Medical College Sola, S.G. Highway, Ahmedabad, Gujarat, India, 380060.

*Corresponding author: Bela A. Patel; *Belapatel2606@gmail.com*

Received 08 May 2023; Accepted 28 May 2023; Published 02 June 2023

Abstract

Background: Thalassemia is an inherited disease. Thalassemia major patients are transfusion-dependent and are very much prone to transfusion-transmitted viral infections. So, this study was conducted to determine the prevalence and various determinants, contributing in blood transfusion transmitted infection among them. ***Methodology:*** A 12-month longitudinal research on thalassemia major patients who met the inclusion criteria and were registered in the thalassemia ward of a tertiary care institution was undertaken from December 2021 to November 2022. Information regarding Transfusion transmitted infection was collected. ***Result:*** This study was applied to a total of 222 thalassemia major patients. The prevalence of Hepatitis C infection found to be 51 (22.97%) followed by HIV 5 (2.25%) and hepatitis B infection was found in one patient (0.45%). When various parameters were compared to Transfusion transmitted infection, only history of splenectomy and place of diagnoses were shown to be substantially related to the TTIs ($p < 0.05$), whereas all other factors were statistically insignificant ($p > 0.05$). ***Conclusion:*** Our findings reveled that HCV is the most common TTI among thalassemia major patients followed by HIV and HBV. Patients who were splenectomized and diagnosed from private hospital were more prone to Transfusion transmitted infection.

Keywords: ***Beta thalassemia major patients, Transfusion transmitted infection, HCV/HBV, HIV***

Introduction

Thalassemia is an inherited disease, and it is considered one of the most common monogenic disorders that lead to chronic haemolytic anaemia. The pathophysiology of thalassemia in general is imbalance between the α/β-globin [1]. It mainly defects in genes result in diminished synthesis of one or more of the globin subunits [2]. They classified according to the severity of clinical presentation into thalassemia major, thalassemia intermediate, and thalassemia minor [3]. These inherited blood disorders generally occur in the countries of thalassemia belt including Mediterranean and portions of West Africa, North Africa, Middle East and South Asian countries including Bangladesh, India, and Sri Lanka. Worldwide, the prevalence of thalassemia 3000 per 100000 [4]. The estimated prevalence of thalassemia worldwide is 300,000,000 [5]. Beta thalassemia carriers are approximately 1.5% of the world population. Every year 10,000 children with thalassemia major are born in India, which constitutes to about 10% of the total number born in the world each year. A higher frequency has been observed in certain communities, such as Sindhis, Punjabis, Gujaratis, Bengalis, Mahars, Kolis, Saraswat, Lohanas and Gaurs [6,7]. Hemoglobinopathies are more common in Gujarat compared to other Indian states. Model and Petrou [8] have estimated 12% incidence of major hemoglobinopathy traits in Gujarat. Several studies have revealed high prevalence of beta thalassemia trait (BTT) in some caste groups in Gujarat. Abnormal haemoglobins D, J and L have been reported in Kutchi, Lohana community of Gujarat [9]. Certain castes and tribes in Gujarat are yet to be investigated for thalassemia and other abnormal haemoglobins.

The only cure available for these children with thalassemia major is bone marrow transplantation (BMT) more appropriately called hematopoietic stem cell transplant (HSCT). However, this can help only a few patients because of cost, paucity of BMT centres, or non-availability of a suitable HLA (Human leucocyte antigen) matched donor. Therefore, the mainstay of treatment is a regimen of regular blood transfusions followed by adequately monitored iron chelation therapy to remove the excessive iron overload-as a consequence of the multiple blood transfusions. Thus, it is a transfusion dependent disorder and places a great burden on healthcare services [10].

A group of patients was the patients with thalassemia, especially the patients with beta thalassemia major (BTM) are transfusion-dependent and these patients are very much prone to transfusion-transmitted viral infections. After heart failure, viral infections are the second most common cause of mortality and the foremost cause of morbidity among the patients with thalassemia followed by patients with bacterial and parasitic infections. Although hepatitis B virus (HBV), hepatitis C virus (HCV), human immunodeficiency virus (HIV), West Nile virus (WNV), human T cell lymphotropic viruses I, II (HTLV-I/II) had been reported most frequently, HCV and HBV had been known as the most prevalent etiological agents of chronic viral hepatitis and hepatocellular carcinoma among the thalassemia patients. Beta thalassemia (BT) are transfusion-dependent and these patients are very much prone to transfusion-transmitted viral infections [11].

Hence, the present study was undertaken in our institute to determine the prevalence, as well as various determinants, contributing in blood transfusion transmitted infection among β-thalassemia major patients. Incidence of TTIs were also determined during the course of the study.

Methodology

Study setting & Participants

An institutional based longitudinal study was conducted at thalassemia ward in pediatric department. Study Duration was 12 months from December 2021 to November 2022. The study included all thalassemia major patients who visited the thalassemia ward during the research period.

The study comprised thalassemia major patients who were registered in the thalassemia ward of a tertiary care facility, granted consent by parents/guardians/participants, and were willing to provide follow-up visits in the hospital. Thalassemia major patients who were not willing to participate and severely ill were excluded from the study. This study employed a non-probability (universal) sampling technique.

Data Collection

After receiving approval from the institutional ethics committee, the study was launched. The patient's parent(s), guardian(s), or relative gave their written approval before data collection began. A predesigned, pre-tested and semi-structured questionnaire prepared which was an adapted from different works of the literature and prepared originally in English. The information was gathered through a face-to-face interview as well as from the case file's recorded data. Each patient received a total of four visits on a quarterly basis. Age, sex, residential area, religion, socioeconomic status, type of card holder, and laboratory data including HCV, HBV, HIV infections, hemoglobin, serum ferritin, serum creatinine, and SGPT (Serum glutamate pyruvate transaminase) were gathered during the initial visit. Other pertinent information was gathered, including consanguinity, participating siblings' status, diagnostic place, transfusion reaction, and H/O splenectomy. The following three visits are made every three months to check for new cases of infection caused by blood transfusions and to gather other laboratory results.

Data Analysis

First, the completeness and consistency of the acquired data were verified. The collected data were organised in a Microsoft Excel spreadsheet before being analysed with SPSS software version 26. The analysis made use of both descriptive and inferential statistics. The chi square test was used for the categorical variable. To account for confounding factors, the multivariate logistic regression model includes variables that were significant in the bivariate analysis. Statistical significance was set at the probability value ($P < 0.05$). For variables that were continuous, Pearson correlation was used.

Result

In the current study, we aimed to determine the prevalence of blood transfusion transmitted infections in thalassemia major patients who are dependent on transfusions. At a tertiary care hospital in the western region of Gujarat, the study was conducted on 222 patients with thalassemia major. Among the 222 thalassemia major patients, prevalence of Hepatitis C, Hepatitis B and HIV infection found to be 51 (22.97%), 1 (0.45%) and 5 (2.25%) respectively. Three (1.35%) new cases of hepatitis C and one (0.45%) new cases of HIV were found during the course of the study. (**Table 1**)

Among the 222 thalassemia major patients, 127 (57.2%) were male and 95 (42.79%) were female. More than one third patients 82 (36.93%) belonged to 10-18 years age group while only 23 (10.36%) belonged to <5 years age group. Nearly three fifth 132 (59.45%) were residing in rural area and majority 188 (84.68%) were Hindu. Majority patients belonged to lower middle (38.73%) and lower (26.57%) socioeconomic class according to modified BG prasad classification. Nearly two third 144 (64.86%) were APL card holder. History of consanguinity was present in 64 (28.82%) patients and 28 (12.61%) had siblings who also had thalassemia major. The majority, 138 (62.16%), had their diagnoses made at the government hospital. Three fifth 134 (60.36%) of the patients had history of febrile transfusion reaction and 34 (15.31%) were splenectomised.

When bivariate analysis was performed, factors such the place of the thalassemia major diagnosis and the history of splenectomy showed a significant association with hepatitis (HBV/HCV) infection but not with HIV infection. Patients diagnosed at private health facilities (35.71%) had a significantly higher proportion of hepatitis infection compared to those who diagnosed at government health facilities (15.94%). Patients with splenectomies had significantly higher infection rate for hepatitis (38.23%). No statistically significant difference observed between blood transfusion transmitted infections and variables like sex, age, place of residence, religion, socioeconomic status, card holder type, consanguinity, sibling status of participants, transfusion reaction. (**Table 2**)

Multivariate logistic regression analysis was performed to study the association between different risk factors and occurrence of transfusion transmitted infection among thalassemia major patients. The analysis revealed that place of diagnosis and history of splenectomy were significantly associated with transfusion transmitted infection. Odds of having TTI's were 2.269 times (AOR = 2.269, 95% CI : 1.215 - 4.240) higher in those who were diagnosed at private health facility and 2.223 times (AOR = 2.223, 95% CI : 1.018 - 4.852) higher in those who were splenectomised. (**Table 3**)

The mean haemoglobin level at baseline and one year afterwards did not significantly differ (p value > 0.05) (**Figure 1**).

The correlation between haemoglobin, serum ferritin, and SGPT is displayed in the correlation matrix. Although the difference was statistically insignificant (p value > 0.05), haemoglobin level exhibits a positive correlation with serum ferritin ($r = 0.11$) and a negative correlation with SGPT ($r = -0.09$) while the serum ferritin and SGPT have a statistically significant positive correlation ($r = 0.16$, $p < 0.05$). (**Figure 2**)

Table 1: Prevalence of various blood transfusion transmitted infections among thalassemia major patients

Blood transfusion transmitted infections	Total cases	(%)	New cases	(%)
Hepatitis C	51	22.97	3	1.35
Hepatitis B	01	0.45	0	0
HIV	5	2.25	1	0.45

Table 2: Association between various determinants and blood transfusion transmitted infections among thalassemia major patients

Variables	N (%)	HIV		P value	HCV/HBV		P value
		Yes	No		Yes	No	
Sex							
Male	127 (57.2)	3 (2.36)	124 (97.63)	0.8	30 (23.62)	97 (76.37)	0.9
Female	95 (42.79)	2 (2.1)	93 (97.89)		22 (23.15)	73 (76.84)	
Age							
0-5	23 (10.36)	0 (0)	23 (100)	0.6	2 (8.69)	21 (91.3)	0.2
5-10	48 (21.62)	0 (0)	48 (100)		10 (20.83)	38 (79.16)	
10-18	82 (36.93)	4 (4.87)	78 (95.12)		20 (24.39)	62 (75.6)	
>18	69 (31.1)	1 (1.44)	68 (98.55)		20 (28.98)	49 (71.01)	
Residence							
Rural	132 (59.45)	4 (3.03)	128 (96.96)	0.6	30 (22.72)	103 (78.03)	0.7
Urban	90 (40.54)	1 (1.11)	89 (98.88)		22 (24.44)	67 (74.44)	
Religion							
Hindu	188 (84.68)	3 (1.59)	185 (98.4)	0.3	42 (22.34)	146 (77.65)	0.4
Muslim	34 (15.31)	2 (5.88)	32 (94.11)		10 (29.41)	24 (70.58)	
Socio-economic status							
I	14 (6.3)	0 (0)	14 (100)	0.9	5 (35.71)	9 (64.28)	0.09
II	16 (7.2)	0 (0)	16 (100)		2 (12.5)	14 (87.5)	
III	47 (21.17)	0 (0)	47 (100)		7 (14.89)	40 (85.1)	
IV	86 (38.73)	3 (3.48)	83 (96.51)		27 (31.39)	59 (68.6)	
V	59 (26.57)	2 (3.38)	57 (96.61)		11 (18.64)	48 (81.35)	
Type of Card holder							
BPL	78 (35.13)	2 (2.56)	76 (97.43)	0.8	19 (24.35)	59 (75.64)	0.8
APL	144 (64.86)	3 (2.08)	141 (97.9)		33 (22.91)	111 (77.08)	
Consanguinity							
Yes	64 (28.82)	2 (3.12)	62 (96.87)	0.9	20 (31.25)	44 (68.75)	0.08
No	158 (71.17)	3 (1.89)	155 (98.1)		32 (20.25)	126 (79.74)	
Sibling Status of Participants.							
Thal. Minor	194 (87.38)	4 (2.06)	190 (97.93)	0.8	47 (24.22)	147 (75.77)	0.4
Thal. Major	28 (12.61)	1 (3.57)	27 (96.42)		5 (17.85)	23 (82.14)	
Diagnostic place							
Govt.	138 (62.16)	4 (2.89)	134 (97.1)	0.7	22 (15.94)	116 (84.05)	0.007
Private	84 (37.83)	1 (1.19)	83 (98.8)		30 (35.71)	54 (64.28)	
Transfusion reaction							
Febrile	134 (60.36)	5 (3.73)	129 (96.26)	0.17	31 (23.13)	103 (76.86)	0.8
Afebrile	88 (39.63)	0 (0)	88 (100)		21 (23.86)	67 (76.13)	
H/o Splenectomy.							
Yes	34 (15.31)	1 (2.94)	33 (97.05)	0.7	13 (38.23)	21 (61.76)	0.02
No	188 (84.68)	4 (2.12)	184 (97.87)		39 (20.74)	149 (79.25)	

Table 3: Multivariate logistic regression analysis for determinants of transfusion transmitted infection among thalassemia major patients

Variable	Category	Transfusion Transmitted Infection		OR (95% CI)	p value
		Present	Absent		
Place of Diagnosis	Private	30 (35.71)	54 (64.29)	2.269 (1.215-4.240)	0.01
	Govt.	26 (18.84)	112 (81.16)	Reference	
Splenectomy	Yes	14 (41.18)	20 (58.82)	2.223 (1.018-4.852)	0.045
	No	42 (22.34)	146 (77.66)	Reference	

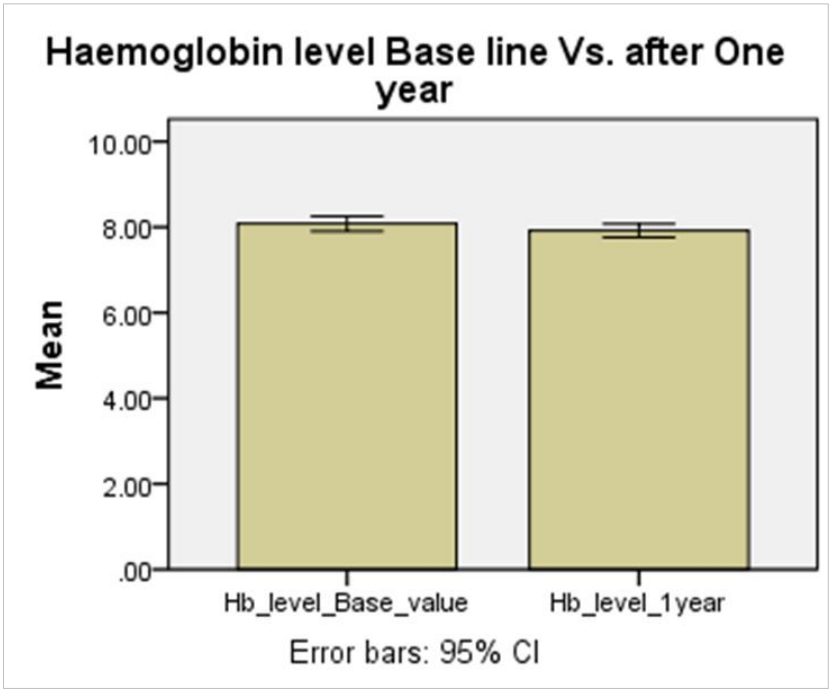

Figure 1: Haemoglobin level base line Vs after one year

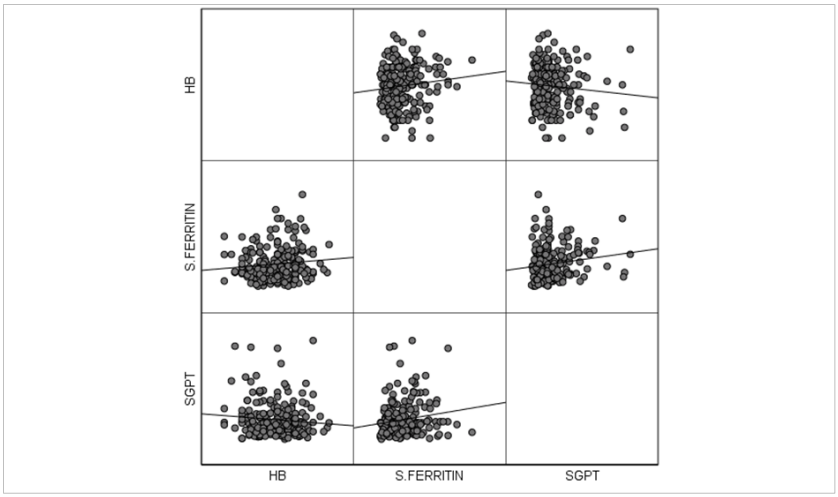

Figure 2: Correlation matrix between various laboratory parameters

Discussion

This study conducted on 222 thalassemia major patients who were registered in the thalassemia ward of a tertiary care facility. HCV infection rates were 22.97% among 222 patients with transfusion-dependent thalassemia major, while HIV and HBV infection rates were 2.25% and 0.45%, respectively. HBV infection rates were lower than HCV infection rates. This low number can be attributable to the HBV vaccination becoming accessible. Patients with thalassemia major had a greater prevalence of HCV, which was consistent with earlier research [12-14].

HIV prevalence in the current study was 2.36% in male and 2.1% in female, whereas HCV/HBV prevalence was 23.62% in male and 23.15% in female. The observed gender difference was statistically insignificant. Similar findings were found in research by Sinha et al. [15] and Rizwan kiani et al [16].

The HIV infection was observed only in ≥10 years age group and prevalence of HBV/HCV was also higher in ≥10 years age group in this study. However, this difference was statistically not significant. The lower number of transfusions in < 10 years old age group compared to ≥10 years age may have contributed to low frequency of TTIs among patients of <10 years age. Similar findings were made in the study by Yasmeen H. et al. [12], who showed that seroprevalence was considerably greater in patients with >10 years age while Sinha et al. [15] in their study found higher prevalence of HCV infection in 5-9 years of age group.

Prevalence of HIV was higher among the patients who belonged to rural area while prevalence of hepatitis infection was higher among those who belonged to urban area. Although this difference was statistically not significant. Biswas et al. [17] in their study reported that transfusion transmitted infection was significantly higher in patients who belonged to Rural area compared to urban area (p - 0.01).

In our study, Muslim patients had higher HIV and hepatitis prevalence than Hindu patients, which was in contrast to Shrivastva Manisha et al.'s [18] study, which found that Hindu patients had higher TTI than Muslim patients. Prevalence of TTI was higher in lower socioeconomic class patients in our study while the inverse finding was reported by Shrivastva Manisha et al. [18] in their study.

In the current study, the prevalence of TTI was nearly comparable among patients with BPL and APL cards. Patients with a history of consanguinity had a higher prevalence of TTI than patients without such history, although this difference was statistically insignificant. The finding is supported with study by Mostafa Sadeghi et al [19] and Yasmeen H et al [12].

Prevalence of HBV/HCV was significantly higher among the patients who were diagnosed at private health facility compared to those who diagnosed at government health facility.

As a component of the immune system, the spleen performs an essential function for our bodies by filtering our blood. In this study, we found that prevalence of HBV/HCV was significantly higher among the patients who were splenectomised, similar result seen in study by Attaullah MJ et al. [20] where history of Splenectomy ($p < 0.05$) substantially related with HCV infection.

In study by Mostafa Sadeghi et al [19] shown that odds of having HCV infection was 3.73 times (CI: 1.82-7.66, p value = 0.001) in those who were splenectomised as compared to their contrary part. Post splenectomy sepsis considered to be higher among thalassemia major patients [21].

The odd of having transfusion transmitted infection was 2.269 times higher among thalassemia major patients those who were diagnosed at private hospital as compared to Government hospital and the risk of transfusion transmission infection tended to be 2.223 times higher among the thalassemia major patients those who were Splenectomised in our study.

Conclusion

The findings of this study showed that among transfusion-dependent beta-thalassemia major patients, hepatitis C infection was the most frequent transfusion-transmitted infection. Patients who underwent splenectomies and whose diagnoses were from a private hospital were more prone to infections spread by transfusion.

Hepatitis B vaccine should be administered to all patients. It is necessary to adopt more accurate screening procedures for HBV, HIV, and HCV. It is important to follow the recommended safety precautions for transfusion procedures.

Ethics approval and consent to participate

Study was approved by Institutional Ethical Committee, M.P.Shah Govt. Medical college & Guru Gobind Singh Hospital, Jamnagar with reference number EC/NEW/INST/2021/1896. Verbal consent was obtained from each respondent.

List of abbreviations

APL: Above poverty line
BMT: Bone marrow transplantation
BT: Beta thalassemia
BTM: Beta thalassemia major
BTT: Beta thalassemia trait
HBV: Hepatitis B virus
HCV: Hepatitis C virus
HLA: Human leucocyte antigen
HSCT: Hematopoietic stem cell transplant
HTLV: Human T cell lymphotropic viruses
SGPT: Serum glutamate pyruvate transaminase
SPSS: Statistical package for social sciences
TTI: Transfusion transmitted infections
WNV: West Nile virus

Data Availability

Readers can access the data by contacting the corresponding author via email on Belapatel2606@gmail.com

Conflicts of Interest

The authors declares that there is no conflict of interest regarding the publication of this paper.

Funding Statement

Nil

Authors' contributions

AP collected and analysed the data regarding transfusion transmitted infections in beta thalassemia major patients. HP and BP contributed significantly to the writing and editing of the manuscript in addition to analysing and interpreting the patient's data.VS was a major contributor in study designing, manuscript editing and review.

References

[1] Taher AT, Weatherall DJ, Cappellini MD. Thalassaemia. Lancet 2018; 391: 155-67.
[2] Kumar V, Abbas A, Fausto N, Aster J, et al. Red blood cell and bleeding disorders. Robbins & Cotran Pathologic Basis of Disease 2010: 629-56.
[3] Teawtrakul N, Jetsrisuparb A, Sirijerachai C, et al. Severe bacterial infections in patients with non-transfusion dependent thalassemia: prevalence and clinical risk factors. Int J Infect Dis 2015; 39: 53-6.
[4] Waheed F, Fisher C, Awofeso A, Stanley D (2016). "Carrier screening for beta-thalassemia in the Maldives: perceptions of parents of affected children who did not take part in screening and its consequences". J Community Genet. 7 (3): 243–53.
[5] Adib-Hajbaghery M, Ahmadi M, S P (2015). "Health Related Quality of Life, Depression, Anxiety and Stress in Patients with Beta-Thalassemia Major". Iran J Ped Hematol Oncol. 5 (4): 193–205. PMC 4779154. PMID 26985352.
[6] Balgir RS. Genetic epidemiology of the three predominant abnormal hemoglobins in India. J Assoc. Physicians of India. 1996, 44 (1) 25-28.
[7] Manglani M, Pandorwala M, Sharma R, Lokeshwar MR. Thalassemia Syndromes, Text Book of Paediatric Haematology and Haemato-Oncology. New Delhi: The Health Sciences Publishers; 2016. p. 163-4.
[8] Modell B, Petrou M. The problem of the hemoglobinopathies in India. Ind J Hematol 1983; 1:5-16.
[9] Bhatia HM, Shanbagh SR, Baxi AJ, Bapat JP, Sharma RS. Genetic studies among the endogamous groups of Lohanas of North and West India. Hum Hered 1976; 26:298-305.
[10] Ministry of health and family welfare, Government of India. Prevention and control of hemoglobinopathies in India- Thalassemia, Sickle cell disease and other variant hemoglobins 2016. New Delhi, India; 2016.p 20.
[11] Bhuyan GS, Noor AU, Sultana R, Noor FA, Sultana N, Sarker SK, Islam MT, Sayeed MA, Khabir MI, Hossain AE, Zeba Z. Frequency of hepatitis B, C and HIV infections among transfusion-dependent beta thalassemia patients in Dhaka. Infectious Disease Reports. 2021 Jan 15;13(1):89-95.
[12] Yasmeen H, Hasnain S. Epidemiology and risk factors of transfusion transmitted infections in thalassemia major: A multicenter study in Pakistan. Hematology, Transfusion and Cell Therapy. 2019;41 (4):316–23.
[13] Din G, Malik S, Ali I, Ahmed S, Dasti JI. Prevalence of hepatitis C virus infection among thalassemia patients: a perspective from a multi-ethnic population of Pakistan. Asian Pac J Trop Med. 2014;7: S127–33.
[14] Ansari SH, Shamsi TS, Khan MT, Perveen K, Farzana T, Erum S. Seropositivity of hepatitis C, hepatitis B and HIV in chronically transfused-thalassaemia major patients. J Coll Phys Surg Pak. 2012;22(9):610–1.
[15] Mithilesh k Sinha, babita Raghuwanshi, Bijayanimala Mishra. Menace of Hepatitis C virus among multitransfused thalassemia Patients in Balasore District

Of Odisha state in india.journal of family medicine and primary care.2019;8:2850-4.

[16] Ahmed Kiani R, Anwar M, Waheed U, Asad MJ, Abbasi S, Abbas Zaheer H. Epidemiology of transfusion transmitted infection among patients withβ-thalassaemia major in Pakistan. Journal of Blood Transfusion. 2016; 2016:1–5.

[17] Biswas B, Naskar NN, Basu K, Dasgupta A, Basu R, Paul B. Malnutrition, its attributes, and impact on quality of life: An epidemiological study among β-thalassemia major children. Korean Journal of Family Medicine. 2021;42 (1):66–72.

[18] Manisha S, Sanjeev K, Seema N, Dilip C, Rashmi D. A cross-sectional study on burden of hepatitis C, hepatitis B, HIV and syphilis in multi-transfused thalassemia major patients reporting to a Government Hospital of Central India. Indian Journal of Hematology and Blood Transfusion. 2014;31 (3):367–73.

[19] Mostafa Sadeghi, Maryam Soltani, Koorosh Etemad, Maliheh Abdollahi, Mohammad Sayyadi, Mohyedin Barzegar, et al, (2018), "The prevalence of anti HCV infection and its related factors in patients with Beta-Thalassemia in Shiraz-Iran", Pharmacophore, 9(1), 80-84.

[20] Attaullah MJ, Ali T, Jamil S, Aslam K, Hakeem F. Frequency of Transfusion Transmitted Infection among Transfusion Dependent Beta Thalassemia Patients in District Headquarter Hospital Turbat Kech Baluchistan. Annals of the Romanian Society for Cell Biology. 2022 Apr 18;26(01):880-4.

[21] Bisharat N, Omari H, Lavi I, et al. Risk of infection and death among post-splenectomy patients. J Infect 2001; 43: 182-6.