Original Research Article

FREQUENCY OF HEPATITIS B AND C INFECTION AMONG CHILDREN WITH HISTORY OF BLOOD TRANSFUSION ADMITTED IN PEDIATRICS WARD: A DESCRIPTIVE CROSS-SECTIONAL STUDY

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ABSTRACT

Background: Blood transfusion is an important life-saving intervention in pediatric practice, especially among children with severe anemia, hematological disorders, and transfusion-dependent conditions. However, repeated exposure to blood and blood components increases the risk of transfusion-transmitted infections, particularly Hepatitis B and Hepatitis C. Early detection of these infections is essential for timely management and prevention of long-term liver-related complications. **Aim:** To assess the frequency of Hepatitis B and Hepatitis C infection among children with a history of blood transfusion admitted in the pediatric ward.

Materials and Methods: This single-centre descriptive cross-sectional study was conducted in the Pediatric Ward of the Department of Pediatrics, Kamla Raja Hospital and Jayarogya Group of Hospitals, Gajra Raja Medical College, Gwalior, during 2021–2024. A total of 200 children up to 14 years of age with a history of blood transfusion, including both single-transfusion and transfusion-dependent children, were included. Critically ill patients were excluded. After obtaining Institutional Ethics Committee permission and informed consent from parents or guardians, demographic details, transfusion history, anthropometry, vital parameters, vaccination status, and clinical findings were recorded. Blood samples were collected under aseptic precautions and sent to the Department of Microbiology for laboratory analysis. Data were entered in Microsoft Excel and analyzed using SPSS version 18.

Results: Out of 200 children, 185 (92.50%) were seronegative, while 15 (7.50%) were seropositive for Hepatitis B and/or Hepatitis C infection. Hepatitis C was the most common infection, seen in 8 children (4.00%), followed by co-positivity in 4 children (2.00%) and Hepatitis B in 3 children (1.50%). The highest proportion of participants belonged to the 13–14 years age group, 83 (41.50%). Seropositivity was comparable between males and females. Transfusion dependence showed a statistically significant association with seropositivity ($p<0.001$), while age, gender, residence, socioeconomic status, and frequency of transfusion were not significantly associated. No Hepatitis B positivity was observed among completely vaccinated children.

Conclusion: Hepatitis C was the predominant transfusion-transmitted hepatitis infection among children with a history of blood transfusion. Transfusion-dependent children were at significantly higher risk. Regular screening, complete Hepatitis B vaccination, safe transfusion practices, and long-term follow-up are essential to reduce transfusion-transmitted hepatitis infections.

Keywords: Hepatitis B, Hepatitis C, Blood transfusion, Children, Transfusion-transmitted infection.

INTRODUCTION

Blood transfusion is an essential and life-saving therapeutic intervention in pediatric practice. It is commonly required in children admitted with severe anemia, hemoglobinopathies, hematological disorders, malignancies, bleeding disorders, sepsis, trauma, and perioperative conditions. In many pediatric wards, transfusion support forms an important part of emergency as well as long-term management. Children with transfusion-dependent disorders require repeated exposure to blood and blood components over several years, which increases their cumulative risk of transfusion-related complications. Although modern transfusion services have improved considerably, transfusion-transmitted infections continue to remain an important public health concern, especially in settings where the burden of viral hepatitis is high and access to advanced blood screening techniques may be variable.[1] Hepatitis B virus and Hepatitis C virus are among the most important infectious agents transmitted through blood and blood products. Both viruses primarily affect the liver and may lead to acute hepatitis, chronic hepatitis, cirrhosis, liver failure, and hepatocellular carcinoma. In children, these infections are of particular concern because infection acquired at a young age may remain clinically silent for a long period and may progress gradually before detection. Pediatric patients may not present with classical symptoms in the early phase, and therefore infections may be identified only during screening, follow-up testing, or evaluation for liver dysfunction. This silent nature of Hepatitis B and C makes routine screening important in children with a history of transfusion.[2] The safety of transfused blood depends on several steps, including careful donor selection, voluntary blood donation, screening of donated blood, proper storage, rational use of blood components, and post-transfusion surveillance. According to international blood safety recommendations, every blood donation should be screened for major transfusion-transmissible infections, including HIV, Hepatitis B, Hepatitis C, and syphilis, before being released for clinical use. Despite these measures, residual risk may persist due to window-period infections, occult Hepatitis B infection, technical limitations of screening assays, improper donor history, or system-level gaps in blood banking services. These challenges are particularly relevant in resource-limited settings where uniform availability of sensitive testing methods is difficult.[3] Children receiving repeated transfusions represent a vulnerable group because every transfusion episode adds another potential exposure. Patients with thalassemia, sickle cell disease, aplastic anemia, hemophilia, and other chronic hematological conditions may require blood or blood components at regular intervals. In such children, transfusion is not a one-time intervention but a continuing requirement, making long-term monitoring essential. In addition to screening donor blood, periodic testing of recipients for Hepatitis B and C is important for early diagnosis and timely management. Early identification also helps in counseling families, preventing further transmission, monitoring liver function, and initiating appropriate referral for antiviral care when needed.[4] Hepatitis B is preventable through vaccination, and complete immunization remains a major protective strategy. However, transfused children may still require assessment of vaccination status, documentation of completed doses, and evaluation of immune protection where indicated. Incomplete vaccination, unknown vaccination history, malnutrition, chronic illness, and repeated hospitalization may increase vulnerability in pediatric patients. On the other hand, Hepatitis C currently has no widely available vaccine, making prevention dependent mainly on safe blood practices, infection-control measures, screening, and early detection. The difference in prevention strategies for Hepatitis B and Hepatitis C highlights the need to assess both infections separately among transfused children.[5] The diagnosis of Hepatitis B and C infection is based on serological and molecular markers. Hepatitis B surface antigen testing is widely used for HBV screening, while anti-HCV antibody testing is commonly used for HCV exposure. However, molecular testing such as nucleic acid testing can detect viral genetic material earlier and can help reduce the diagnostic window period. Although molecular methods may not be universally available in all centers, they are increasingly recognized as important tools for improving transfusion safety. In pediatric populations, laboratory confirmation should be interpreted along with clinical history, transfusion exposure, vaccination status, and liver-related clinical findings.[6]

MATERIALS AND METHODS

This was a single-centre descriptive cross-sectional study conducted in the Pediatric Ward of the Department of Pediatrics, Kamla Raja Hospital and Jayarogya Group of Hospitals, Gajra Raja Medical College, Gwalior. The study was carried out over a period of three years, from 2021 to 2024. The study included children admitted with a history of blood transfusion, including both children who had received a single blood transfusion and those who were dependent on multiple blood transfusions.

Methodology

The study population comprised all children up to 14 years of age who had a history of blood transfusion or were transfusion-dependent and were admitted to the Pediatric Ward during the study period. A total sample size of 200 children was included in the study. Children fulfilling the inclusion criteria were enrolled after obtaining informed consent from their parents or guardians. The inclusion criterion was all children up to 14 years of age with a history of blood

transfusion or transfusion dependence. Critically ill patients were excluded from the study.
After obtaining permission from the Institutional Ethics Committee, eligible cases were enrolled in the study. Detailed information was recorded using a predesigned data collection format. The collected data included demographic profile, detailed history of blood transfusion, anthropometric measurements, and vital parameters. Blood samples were collected from each participant under recommended aseptic precautions and were sent to the laboratory of the Department of Microbiology, Gajra Raja Medical College, Gwalior, for analysis. The collected data were entered into a Microsoft Excel spreadsheet and analyzed using SPSS software version 18. Data were presented using appropriate descriptive statistical methods.

RESULTS

Table 1 shows the baseline demographic profile of the 200 study participants. The highest proportion of children belonged to the 13–14 years age group, comprising 83 cases (41.50%), followed by 4–6 years with 47 cases (23.50%), 7–9 years with 43 cases (21.50%), and 10–12 years with 27 cases (13.50%). The gender distribution was almost equal, with 98 males (49.00%) and 102 females (51.00%). A slightly higher number of participants were from rural areas, 106 (53.00%), compared to 94 (47.00%) from urban areas. Socioeconomic distribution was nearly equal among the lower, middle, and upper classes, accounting for 67 (33.50%), 65 (32.50%), and 68 (34.00%) cases, respectively. Regarding nutritional status, most children had normal nutrition, 130 (65.00%), while 59 (29.50%) had thinness and 11 (5.50%) had severe thinness.
Table 2 presents the overall seropositivity among the study participants. Out of 200 children, 185 (92.50%) were seronegative, while 15 (7.50%) were seropositive for transfusion-transmitted hepatitis markers. Among the seropositive cases, Hepatitis C was the most common, observed in 8 children (4.00%), followed by co-positivity in 4 children (2.00%) and Hepatitis B in 3 children (1.50%).
Table 3 describes the association of seropositivity with age, gender, and residence. Among age groups, the highest proportion of Hepatitis C positivity was seen in the 10–12 years age group, with 3 cases (11.11%), followed by 13–14 years with 4 cases (4.81%). Hepatitis B positivity was observed in 1 child (3.70%) in the 10–12 years group and 2 children (2.40%) in the 13–14 years group. Co-positivity was seen in 2 children (4.25%) aged 4–6 years, 1 child (2.32%) aged 7–9 years, and 2 children (2.40%) aged 13–14 years. However, the association between age and seropositivity was not statistically significant (p=0.334). Gender-wise, seropositivity was comparable between males and females. Hepatitis B was slightly higher among males, while co-positivity was higher among females, but the association was not statistically significant (p=0.851). Rural children showed slightly higher Hepatitis B, Hepatitis C, and co-positivity than urban children, but this difference was also not statistically significant (p=0.270).
Table 4 shows seropositivity according to socioeconomic and nutritional status. Among socioeconomic classes, Hepatitis C positivity was highest in the upper class, with 5 cases (7.35%), while co-positivity was highest in the lower class, with 3 cases (4.47%). Hepatitis B was seen in 1 child (1.54%) from the middle class and 2 children (2.94%) from the upper class. The association between socioeconomic status and seropositivity was not statistically significant (p=0.560). With regard to nutritional status, Hepatitis C was observed in 5 normal children (3.84%) and 3 children with thinness (5.08%). Hepatitis B positivity was seen in 2 children with thinness (3.38%) and 1 child with severe thinness (9.09%). Co-positivity was seen in 3 children with normal nutrition (2.30%) and 1 child with thinness (1.69%).
Table 5 explains the transfusion-related characteristics and their association with seropositivity. Among children who had received a single transfusion, 8 out of 99 were seropositive, including 1 Hepatitis B case, 5 Hepatitis C cases, and 2 co-positive cases. Among children with multiple transfusions, 7 out of 101 were seropositive, including 2 Hepatitis B cases, 3 Hepatitis C cases, and 2 co-positive cases. The association between frequency of transfusion and seropositivity was not statistically significant (p=0.758). However, transfusion dependence showed a statistically significant association with seropositivity (p<0.001). Among transfusion-dependent children, Hepatitis C positivity was higher, with 6 cases (5.58%), compared to 2 cases (2.15%) among non-dependent children. Regarding blood components, most children had received packed cell volume, and this group showed 4 Hepatitis C cases, 2 Hepatitis B cases, and 1 co-positive case. The highest co-positivity was observed among children receiving PRP, with 3 cases (8.82%).
Table 6 summarizes Hepatitis B vaccination status, clinical presentation, and viral load findings. Among unvaccinated children, seropositivity was comparatively higher, with 2 Hepatitis B cases (2.98%), 3 Hepatitis C cases (4.47%), and 4 co-positive cases (5.97%). No Hepatitis B positivity was observed among completely vaccinated children, suggesting a protective role of complete vaccination against Hepatitis B. Clinically, jaundice was present in 110 children, among whom 2 had Hepatitis B, 4 had Hepatitis C, and 3 were co-positive. Hepatomegaly was present in 103 children, with 2 Hepatitis B cases, 5 Hepatitis C cases, and 2 co-positive cases. Splenomegaly was present in 97 children, with 1 Hepatitis B case, 4 Hepatitis C cases, and 2 co-positive cases. Among the 15 seropositive participants, the mean viral load for Hepatitis B was $5.38 \pm 2.32 \times 10^3$ IU/ml, with a 95% confidence interval of 3.23–7.53, while the mean viral load for

Hepatitis C was 4.85 ± 2.02 × 10^3 IU/ml, with a 95% confidence interval of 3.57–6.14.

Table 1: Baseline Demographic Characteristics of Study Population (N=200)

Variable	Category	n	%
Age	4–6 years	47	23.50
	7–9 years	43	21.50
	10–12 years	27	13.50
	13–14 years	83	41.50
Gender	Male	98	49.00
	Female	102	51.00
Residence	Rural	106	53.00
	Urban	94	47.00
Socioeconomic status	Lower	67	33.50
	Middle	65	32.50
	Upper	68	34.00
Nutritional status	Normal	130	65.00
	Thinness (<−2 SD)	59	29.50
	Severe thinness (<−3 SD)	11	5.50

Table 2: Overall Seropositivity among Study Participants (N=200)

Outcome	n	%
Seronegative	185	92.50
Hepatitis B	3	1.50
Hepatitis C	8	4.00
Co-positive	4	2.00
Total	200	100.00

Table 3: Association of Seropositivity with Demographic Characteristics

Variable	Category	Total	Negative n (%)	Hepatitis B n (%)	Hepatitis C n (%)	Co-positive n (%)	P-value
Age	4–6 years	47	45 (95.74)	0 (0.00)	0 (0.00)	2 (4.25)	0.334
	7–9 years	43	41 (95.34)	0 (0.00)	1 (2.32)	1 (2.32)	
	10–12 years	27	23 (85.18)	1 (3.70)	3 (11.11)	0 (0.00)	
	13–14 years	83	76 (91.56)	2 (2.40)	4 (4.81)	2 (2.40)	
Gender	Male	98	91 (92.85)	2 (2.04)	4 (4.08)	1 (1.02)	0.851
	Female	102	94 (92.15)	1 (0.98)	4 (3.92)	3 (2.94)	
Residence	Rural	106	96 (90.56)	2 (1.88)	5 (4.71)	3 (2.83)	0.270
	Urban	94	89 (94.68)	1 (1.06)	3 (3.19)	1 (1.06)	

Table 4: Association of Seropositivity with Socioeconomic and Nutritional Status

Variable	Category	Total	Negative n (%)	Hepatitis B n (%)	Hepatitis C n (%)	Co-positive n (%)	P-value
Socioeconomic status	Lower	67	63 (94.02)	0 (0.00)	1 (1.49)	3 (4.47)	0.560
	Middle	65	61 (93.84)	1 (1.54)	2 (3.07)	1 (1.54)	
	Upper	68	61 (89.70)	2 (2.94)	5 (7.35)	0 (0.00)	
Nutritional status	Normal	130	122 (93.84)	0 (0.00)	5 (3.84)	3 (2.30)	—
	Thinness (<−2 SD)	59	53 (89.83)	2 (3.38)	3 (5.08)	1 (1.69)	
	Severe thinness (<−3 SD)	11	10 (90.90)	1 (9.09)	0 (0.00)	0 (0.00)	

Table 5: Transfusion-related Characteristics and Seropositivity

Variable	Category	Total	Negative n (%)	Hepatitis B n (%)	Hepatitis C n (%)	Co-positive n (%)	P-value
Frequency of transfusion	Single	99	91 (91.91)	1 (1.01)	5 (5.05)	2 (2.02)	0.758
	Multiple	101	94 (93.06)	2 (1.98)	3 (2.97)	2 (1.98)	
Transfusion dependence	No	93	88 (94.62)	1 (1.07)	2 (2.15)	2 (2.15)	<0.001
	Yes	107	92 (85.98)	2 (1.86)	6 (5.58)	2 (1.86)	
Blood component	PRP	34	28 (82.35)	1 (2.94)	2 (5.88)	3 (8.82)	—
	FFP	26	24 (92.30)	1 (3.84)	1 (3.84)	0 (0.00)	
	Clotting factor	13	12 (92.30)	0 (0.00)	1 (7.69)	0 (0.00)	
	PCV	127	120 (94.48)	2 (1.57)	4 (3.14)	1 (0.78)	

Table 6: Clinical, Vaccination, Diagnostic and Viral Load Profile

Variable	Category	Total	Negative n (%)	Hepatitis B n (%)	Hepatitis C n (%)	Co-positive n (%)
Hepatitis B vaccination	No	67	58 (86.56)	2 (2.98)	3 (4.47)	4 (5.97)
	Partial	69	66 (95.65)	1 (1.44)	2 (2.89)	0 (0.00)
	Complete	64	61 (95.31)	0 (0.00)	3 (4.68)	0 (0.00)
Jaundice	No	90	84 (93.33)	1 (1.11)	4 (4.44)	1 (1.11)
	Yes	110	101 (91.81)	2 (1.81)	4 (3.63)	3 (2.70)
Hepatomegaly	No	97	91 (93.81)	1 (1.03)	3 (3.09)	2 (2.06)
	Yes	103	94 (91.26)	2 (1.94)	5 (4.85)	2 (1.94)
Splenomegaly	No	103	95 (92.23)	2 (1.94)	4 (3.88)	2 (1.94)
	Yes	97	90 (92.78)	1 (1.03)	4 (4.12)	2 (2.06)

Additional viral load findings: Among 15 seropositive participants, the mean viral load for Hepatitis B was 5.38 ± 2.32 × 10^3 IU/ml with 95% CI of 3.23–7.53, while the mean viral load for Hepatitis C was 4.85 ± 2.02 × 10^3 IU/ml with 95% CI of 3.57–6.14.

DISCUSSION

In the present study, the majority of children belonged to the 13–14 years age group, 83 out of 200 cases (41.50%), while the gender distribution was almost equal, with 98 males (49.00%) and 102 females (51.00%). Rural children were slightly more common, 106 (53.00%), than urban children, 94 (47.00%). This pattern shows that older children formed a major proportion of the study population, probably because cumulative exposure to transfusion increases with age. Vidja et al. (2011) also studied 200 multiple-transfused beta-thalassemia major patients and reported transfusion-transmitted infection in 7.00% of cases, with 9 infected males and 5 infected females, showing that both sexes remain at risk in repeatedly transfused children.[7] In this study, overall seropositivity for hepatitis markers was 15 out of 200 cases (7.50%). Hepatitis C was the most common infection, seen in 8 children (4.00%), followed by co-positivity in 4 children (2.00%) and Hepatitis B in 3 children (1.50%). Similar predominance of HCV over HBV has been reported by Jain et al. (2012), who found anti-HCV reactivity in 24 out of 96 multi-transfused thalassemia patients (25.00%), while HBV reactivity was seen in only 1 patient (1.04%).[8] Age-wise, the present study showed highest Hepatitis C positivity in the 10–12 years age group, 3 out of 27 cases (11.11%), followed by the 13–14 years group, 4 out of 83 cases (4.81%). However, the association between age and seropositivity was not statistically significant (p=0.334). Bhavsar et al. (2011) reported HIV positivity of 3.10%, HCV positivity of 7.80%, and HBsAg positivity of 0.52% among thalassemia major children, and noted that increased seropositivity coincided with an increased number of transfusions.[9] In the present study, seropositivity was almost comparable between males and females. Hepatitis B was slightly higher among males, 2 out of 98 cases (2.04%), while co-positivity was higher among females, 3 out of 102 cases (2.94%), but the difference was not statistically significant (p=0.851). Mansour et al. (2012) studied 200 multi-transfused Egyptian thalassemic patients and reported 111 males and 89 females, with anti-HCV positivity in 81 cases (40.50%) and HBsAg positivity in 58 cases (29.00%).[10] Residence-wise, the present study showed slightly higher seropositivity among rural children than urban children. Hepatitis C was seen in 5 rural children (4.71%) compared with 3 urban children (3.19%), while Hepatitis B was seen in 2 rural children (1.88%) and 1 urban child (1.06%); however, this difference was not statistically significant (p=0.270). Agrawal et al. (2017) reported 24.00% HCV prevalence among multi-transfused thalassemic children and found that anti-HCV positive children had a significantly higher transfusion burden than anti-HCV negative children ($p<0.001$).[11]

In relation to socioeconomic status, the present study found Hepatitis C positivity highest in the upper socioeconomic class, 5 out of 68 cases (7.35%), while co-positivity was highest in the lower class, 3 out of 67 cases (4.47%). The association was not statistically significant (p=0.560). Regarding nutritional status, Hepatitis C was seen in 5 normal children (3.84%) and 3 children with thinness (5.08%), while Hepatitis B was seen in 2 children with thinness (3.38%) and 1 child with severe thinness (9.09%). Gomber et al. (2021) found that among children with beta-thalassemia major, seroprotection after primary Hepatitis B vaccination was 72.90%, and all 23 seronegative children achieved seroprotection after a booster dose.[12] Transfusion-related findings showed that seropositivity was 8 out of 99 cases among single-transfusion children and 7 out of 101 cases among multiple-transfusion children, with no significant association between transfusion frequency and seropositivity (p=0.758). However, transfusion dependence was significantly associated with seropositivity ($p<0.001$), and Hepatitis C positivity was higher among transfusion-dependent children, 6 out of 107 cases (5.58%), compared with non-dependent children, 2 out of 93 cases (2.15%). Srivastava et al. (2019) studied thalassemic children receiving multiple transfusions and reported liver function abnormalities, including increased SGOT in 17 out of 32 cases (53.12%), increased SGPT in 15 cases (46.87%), and increased bilirubin in 25 cases (78.12%).[13] Among blood components in the present study, packed cell volume was the most commonly used component, received by 127 children, among whom 4 had Hepatitis C, 2 had Hepatitis B, and 1 was co-positive. The highest co-positivity was observed among children receiving PRP, 3 out of 34 cases (8.82%). Mishra et al. (2020) studied 196 multi-transfused beta-thalassemia patients in Western India and found anti-HCV antibody positivity in 100 cases (51.10%), HCV-RNA positivity in 66 cases (33.70%), HBsAg positivity in 3 cases (1.50%), and HBV-DNA positivity in 5 cases (2.50%).[14] In the present study, unvaccinated children showed comparatively higher seropositivity, with 2 Hepatitis B cases (2.98%), 3 Hepatitis C cases (4.47%), and 4 co-positive cases (5.97%), while no Hepatitis B positivity was observed among completely vaccinated children. Clinically, jaundice was present in 110 children, hepatomegaly in 103 children, and splenomegaly in 97 children. Among 15 seropositive participants, mean viral load was $5.38 \pm 2.32 \times 10^3$ IU/ml for Hepatitis B and $4.85 \pm 2.02 \times 10^3$ IU/ml for Hepatitis C. Mandal et al. (2024) reported NAAT-confirmed HCV infection as the most common infection at 14.21%, followed by HBV at 2.51%, and also reported mean HCV RNA of 741063 ± 438514.67 IU/ml and mean HBV DNA of 4082863 ± 7298514 IU/ml.[15]

CONCLUSION

The present study found that 7.50% of children with a history of blood transfusion were seropositive for Hepatitis B and/or Hepatitis C infection. Hepatitis C was the most common infection, followed by co-positivity and Hepatitis B. Transfusion dependence showed a significant association with seropositivity, highlighting the increased risk among repeatedly transfused children. No Hepatitis B positivity was observed among completely vaccinated children, emphasizing the importance of complete Hepatitis B immunization. Regular screening, safe transfusion practices, and strict follow-up of transfusion-dependent children are essential to reduce transfusion-transmitted hepatitis infections.

REFERENCES

1. World Health Organization. Global hepatitis report 2024: action for access in low- and middle-income countries. Geneva: World Health Organization; 2024. Available from: https://www.who.int/publications/i/item/9789240091672
2. Conners EE, Panagiotakopoulos L, Hofmeister MG, Spradling PR, Hagan LM, Harris AM, et al. Screening and testing for hepatitis B virus infection: CDC recommendations—United States, 2023. MMWR Recomm Rep. 2023;72(1):1-25. doi:10.15585/mmwr.rr7201a1. Available from: https://www.cdc.gov/mmwr/volumes/72/rr/rr7201a1.htm
3. World Health Organization. Blood safety and availability. Geneva: World Health Organization; 2023. Available from: https://www.e-lactancia.org/media/papers/Blood_safety_and_availability-WHO2023_olBXDmf.pdf
4. 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. Int J Immunopathol Pharmacol. 2022;36:3946320221096909. doi:10.1177/03946320221096909. Available from: https://journals.sagepub.com/doi/10.1177/03946320221096909
5. Schillie S, Wester C, Osborne M, Wesolowski L, Ryerson AB. CDC recommendations for hepatitis C screening among adults—United States, 2020. MMWR Recomm Rep. 2020;69(2):1-17. doi:10.15585/mmwr.rr6902a1. Available from: https://www.cdc.gov/mmwr/volumes/69/rr/rr6902a1.htm
6. Pawlotsky JM, Negro F, Aghemo A, Berenguer M, Dalgard O, Dusheiko G, et al. EASL recommendations on treatment of hepatitis C: final update of the series. J Hepatol. 2020;73(5):1170-1218. doi:10.1016/j.jhep.2020.08.018. Available from: https://pubmed.ncbi.nlm.nih.gov/32956768/
7. Vidja PJ, Vachhani JH, Sheikh SS, Santwani PM. Blood transfusion transmitted infections in multiple blood transfused patients of beta thalassaemia. Indian J Hematol Blood Transfus. 2011;27(2):65-69. doi:10.1007/s12288-011-0057-3. Available from: https://pmc.ncbi.nlm.nih.gov/articles/PMC3136674/
8. Jain R, Perkins J, Johnson ST, Desai P, Khatri A, Chudgar U, et al. A prospective study for prevalence and/or development of transfusion-transmitted infections in multiply transfused thalassemia major patients. Asian J Transfus Sci. 2012;6(2):151-154. doi:10.4103/0973-6247.98922. Available from: https://pmc.ncbi.nlm.nih.gov/articles/PMC3439754/
9. Bhavsar H, Patel K, Vegad M, Madan M, Pandey A, Asthana A, et al. Prevalence of HIV, hepatitis B and hepatitis C infection in thalassemia major patients in tertiary care hospital, Gujarat. Natl J Integr Res Med. 2011;2(3):47-50. doi:10.70284/njirm.v2i3.1920. Available from: https://nicpd.ac.in/ojs-/index.php/njirm/article/view/1920
10. Mansour AK, Aly RM, Abdelrazek SY, Elghannam DM, Abdelaziz SM, Shahine DA, et al. Prevalence of HBV and HCV infection among multi-transfused Egyptian thalassemic patients. Hematol Oncol Stem Cell Ther. 2012;5(1):54-59. doi:10.5144/1658-3876.2012.54. Available from: https://pubmed.ncbi.nlm.nih.gov/22446611/
11. Agrawal S, Sulaniya PK, Garg K, Choudhary R, Sulaniya C. Seroprevalence of hepatitis-C infection in multi-transfused thalassemic children: study from a West Indian tertiary care center. Int J Contemp Pediatr. 2017;4(5):1871-1874. doi:10.18203/2349-3291.ijcp20173802. Available from: https://www.ijpediatrics.com/index.php/ijcp/article/view/1059
12. Gomber S, Yadav R, Dewan P, Ramachandran VG, Puri AS. Requirement of a booster dose of hepatitis B vaccine in children with thalassemia after 5 years of primary vaccination: a prospective study. Indian Pediatr. 2021;58(3):237-240. Available from: https://pubmed.ncbi.nlm.nih.gov/33408283/
13. Srivastava P, Mishra R, Dubey AP, Bagla J. Liver function profile in thalassemic children receiving multiple blood transfusions. Indian J Child Health. 2019;6(11):598-600. doi:10.32677/IJCH.2019.v06.i11.006. Available from: https://mansapublishers.com/ijch/article/view/1953
14. Mishra K, Shah A, Patel K, Ghosh K, Bharadva S. A seroprevalence of HBV, HCV and HIV-1 and correlation with molecular markers among multi-transfused thalassemia patients in Western India. Mediterr J Hematol Infect Dis. 2020;12(1):e2020038. doi:10.4084/MJHID.2020.038. Available from: https://www.mjhid.org/index.php/mjhid/article/view/2020.038
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. J Family Med Prim Care. 2024;13(5):1780-1786. doi:10.4103/jfmpc.jfmpc_1751_23. Available from: https://pubmed.ncbi.nlm.nih.gov/38948618/