Original Article

Prevalence and Associated Clinical Factors with Hepatitis B, C, and HIV Infections among Sickle Cell Disease Patients: Evidence from a Tertiary Hospital in Northern Nigeria

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ABSTRACT

Sickle cell disease (SCD) is a prevalent genetic disorder in sub-Saharan Africa, with Nigeria bearing the highest burden. The chronic nature of SCD necessitates frequent medical interventions, including blood transfusions, which heighten the risk of transfusion-transmissible infections like hepatitis B virus (HBV). Despite regional data on HBV prevalence among SCD patients in Nigeria, there is limited information from northern regions such as Zaria. The study assessed the prevalence of hepatitis B and C, and HIV, and also assessed its association with clinical variables including blood transfusion, bone pain crises, and hospitalization among SCD patients in Zaria. A cross-sectional study was conducted at a tertiary health facility in Zaria. A total of 311 SCD patients were enrolled across paediatric, adolescent, and adult age groups. Clinical and demographic data were obtained through structured questionnaires and medical records. Serum samples were screened for HBsAg, HCV and HIV antibodies using rapid diagnostic kits. Statistical analysis was performed using SPSS v25, with significance set at $p < 0.05$. The median age of participants was 17 years; 65% were female, and 92.9% had HbSS genotype. Only 269 participants submitted samples for screening for HBsAg (5/269 were positive), although the sample size is 311, while all participants tested negative for HCV and HIV. No statistically significant associations were found between HBsAg status and history of blood transfusion (OR: 1.186; $p = 0.593$), frequency of bone pain crises (OR: 0.977; $p = 0.355$), or hospitalization (OR: 1.190; $p = 0.608$). In conclusion, the low HBsAg prevalence and absence of HCV and HIV seropositivity among SCD patients in Zaria may suggest improvements in transfusion safety, vaccination uptake, and infection control. Continued surveillance, enhanced preventive strategies are recommended to sustain these gains.

Keywords: Hepatitis B virus, HCV, HIV, Sickle cell disease, Zaria.

INTRODUCTION

Sickle cell disease (SCD) is a common inherited hemoglobinopathy characterized by chronic haemolytic anaemia and recurrent vaso-occlusive crises. It is a major public health concern in sub-Saharan Africa, with Nigeria bearing the highest global burden, accounting for approximately 150,000 new births annually with SCD [1]. The chronic nature of the disease and its frequent complications often necessitate repeated hospital visits, blood transfusions, and invasive procedures, thereby increasing the risk of acquiring transfusion-transmissible infections such as hepatitis B virus (HBV), hepatitis C virus (HCV), and human immunodeficiency virus (HIV) [2].

Hepatitis B is a potentially life-threatening liver

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infection caused by the hepatitis B virus, which is transmitted through contact with infected blood or body fluids. Nigeria is classified as a high endemic region for HBV, with general population prevalence estimates ranging from 8% to 12% [3]. SCD patients are at heightened risk of HBV infections due to repeated transfusions, invasive interventions, and prolonged healthcare exposure[4].

Studies conducted in various regions of Nigeria have reported variable HBsAg seroprevalence among SCD populations. For example, prevalences of 29.2% in Benin City [5], 24.0% in Uyo [6], and 18.9% in Jos [7] have been documented, indicating significant regional differences and highlighting the importance of local epidemiological surveillance. Despite this, there is limited data on the burden of HBV among SCD patients in northern Nigeria, particularly in Zaria, where routine screening and vaccination practices may differ.

Hepatitis C virus (HCV), like HBV, is primarily transmitted through contact with infected blood and is a major cause of chronic liver disease. Nigeria has an intermediate HCV prevalence in the general population, estimated between 1.1% and 2.2%, although higher rates have been reported among individuals with increased transfusion exposure, such as patients with SCD [8]. In the context of SCD, the cumulative risk from multiple transfusions over time underscores the need for rigorous blood screening and monitoring. The prevalence of HCV in SCD patients at Uyo was 18.7%[6].

Similarly, human immunodeficiency virus (HIV) remains a significant public health challenge in Nigeria, which ranks among the countries with the highest HIV burden globally. As of recent estimates, the national adult HIV prevalence is about 1.4%, with regional variations [9]. SCD patients, due to frequent hospitalizations and potential exposure to unsterile procedures or inadequately screened blood products, may be at increased risk, although limited data are available on HIV prevalence within this specific population in northern Nigeria.

This study aimed to determine the prevalence of hepatitis B surface antigen (HBsAg), as well as HCV and HIV infections, and assess their associations with key clinical variables such as blood transfusion, bone pain crises, and hospitalization among SCD patients in Zaria. The findings will contribute to understanding the burden of these infections in this vulnerable group and inform preventive strategies.

MATERIALS AND METHODS

Following ethical approval from the institutional review board of Ahmadu Bello University Teaching Hospital Zaria (Reference No ABUTHZ/HREC/W48/2022 effected from 3rd June 2022), we conducted a hospital-based cross-sectional study among paediatric, adolescent, and adult patients diagnosed with sickle cell disease (SCD) who attended the hematology outpatient clinics at a tertiary health facility in Zaria, Nigeria. The study took place between June to September 2022. Informed consent (and assent where appropriate) was obtained from all participants or their legal guardians prior to enrolment in the study.

Participants were recruited consecutively over the study period if they met the inclusion criteria: confirmed diagnosis of SCD (HbSS, HbSC, or HbSβ-thalassemia), regular attendance at the clinic for follow-up care, and willingness to participate. Patients with a history of recent acute illness or those who declined consent were excluded.

Demographic and clinical information—including age, sex, genotype, frequency of vaso-occlusive crises, history of blood transfusion, and hospitalization within the preceding 12 months—was obtained through interviewer-administered structured questionnaires and verified with patient medical records.

Peripheral blood samples were collected using aseptic technique for laboratory analysis. Sera were screened for hepatitis B surface antigen (HBsAg), hepatitis C virus (HCV) antibodies, and retroviral antibodies using rapid diagnostic test kits validated for clinical use, in accordance with manufacturer instructions (CTK Biotech for HBsAg and HCV and Determine kits for HIV). Only participants with complete demographic, clinical, and laboratory data were included in the final analysis.

Data were entered into a spreadsheet and analyzed using SPSS version 25. Descriptive statistics were used to summarize the demographic and clinical

characteristics. Associations between HBsAg status and categorical variables were assessed using chi-square or Fisher's exact tests as appropriate. Odds ratios (ORs) with 95% confidence intervals (CIs) were computed to evaluate the strength of associations. A p-value < 0.05 was considered statistically significant

RESULTS

The median (IQR) age of the study participants was 17.0 (9.0, 25.0) years. Females constituted 65.0% (202/311) of the participants. Participants with HbSS were 92.9% (289/311) while HbSS+F and HbSC were 7(2.3%) and 15(4.8%) respectively. Paediatric patients were 25.9% (80/309), adolescents 10 to 19 years were 99(32.0%) and adults 130(42.1%).

HCV antibody and HIV screening were non reactive in the study population. HBsAg screening revealed that 1.9% (5/269) participants were reactive

Among participants who had not received a blood transfusion in the past year (as shown in Table 1), 169 were HBsAg-negative and two were HBsAg-positive. Among those who had received a transfusion, 95 were HBsAg-negative and three were HBsAg-positive. The odds of HBsAg positivity among those with a history of blood transfusion were not significantly different (odds ratio [OR] = 1.186; 95% CI: 0.195–7.223; p = 0.593).

Regarding bone pain crises in the past year, Table 1 shows that among those with three or fewer episodes, 214 were HBsAg-negative and five were HBsAg-positive. Among participants with more than three episodes, 50 were HBsAg-negative and none were HBsAg-positive. The odds of HBsAg positivity did not show a significant association with frequency of bone pain crisis (OR = 0.977; 95% CI: 0.958–0.997; p = 0.355).

Table 1 displays hospitalisations within the last year, 147 HBsAg-negative and three HBsAg-positive individuals reported no hospitalisations, while 117 HBsAg-negative and two HBsAg-positive individuals had at least one hospitalisation. There was no significant association between hospitalisation history and HBsAg positivity (OR = 1.190; 95% CI: 0.202–7.007; p = 0.608). HCV and HIV screenings were non-reactive, while HBsAg was positive in 1.9% of cases, with no statistically significant association observed between HBsAg positivity and history of blood transfusion, bone pain crises, or hospitalisation.

Table 1: Association between HBsAg status and SCD crises

Clinical correlates		HBsAg		Odd ratio	95% CI	P value
		Negative	Positive			
Blood transfusion in	Nil	169	2	1.186	0.195 - 7.223	0.593
the last 1 year	Yes	95	3			
Bone pain crisis in the	≤ 3	214	5	0.977	0.958 - 0.997	0.355
last 1 year	> 3	50	0			
No of Hospitalisation	Nil	147	3	1.190	0.202 - 7.007	0.608
in the last 1 year	Yes	117	2			

DISCUSSION

This study assessed the prevalence of hepatitis B surface antigen (HBsAg) among individuals with sickle cell disease (SCD) in Zaria, Nigeria, and explored associations with selected clinical variables. The observed HBsAg prevalence of 1.9% is substantially lower than reports from other parts of Nigeria and some developing countries. Notably, this finding contrasts with earlier Nigerian studies that reported higher HBsAg prevalence among SCD populations, such as 29.2% in Benin City [5], 24.0% in Uyo [6], and 18.9% in Jos [7].

The comparatively lower prevalence in our cohort may reflect recent improvements in transfusion safety practices, particularly the adoption of more rigorous blood screening protocols by the National Blood Transfusion Service (NBTS). Additionally, increasing awareness and uptake of hepatitis B

vaccination in the general population, including children with chronic illnesses like SCD, may have contributed to the reduced infection rate. Nigeria's inclusion of the HBV vaccine in the national immunization schedule since 2004 may have significantly benefited the younger subset of our study population [3].

Interestingly, we found no statistically significant association between HBsAg positivity and history of blood transfusion, frequency of bone pain crises, or hospitalization within the past year. This aligns with findings by Emeribe and Eke in Jos, who also reported no significant association between transfusion history and HBsAg seropositivity [7]. This suggests a possible decline in transfusion-transmitted HBV risk due to enhanced screening protocols. However, continued vigilance is essential given the lifelong transfusion requirements of many SCD patients.

International comparisons also support our findings. A study in Oman reported an HBsAg prevalence of 2.3% among SCD patients [10], and a Ghanaian study documented a 3.6% prevalence [11]—both consistent with our observed rate. These relatively low figures could similarly reflect better infection control, blood safety measures, and early childhood vaccination strategies in these settings.

It is worth noting that while this study did not demonstrate a high burden of HBV, the small number of HBsAg-positive cases may have limited the statistical power to detect associations with clinical variables. Moreover, given that the sample consisted predominantly of patients from a single centre, caution should be exercised in generalizing these findings to all SCD patients in northern Nigeria. Although Ahmadu Bello University Teaching Hospital serves as a referral center for northern Nigeria, the single-center nature of the study may still limit generalizability

In addition to HBV, this study also screened for HCV and HIV, both of which returned non-reactive results across all participants. This zero-prevalence finding is particularly significant, considering the historical vulnerability of sickle cell disease (SCD) patients to transfusion-transmissible infections. The absence of HCV and HIV seropositivity likely reflects substantial improvements in blood safety protocols, donor screening, and infection control measures implemented nationally over the past two decades. The Nigerian National Blood Transfusion Service (NBTS), established in 2006, has played a critical role in improving the quality and safety of donated blood through standardized procedures, donor selection criteria, and the introduction of fourth-generation ELISA testing for HIV and HCV [12].

Previous studies in Nigeria reported variable prevalence rates of HCV and HIV among individuals with SCD, often linked to inconsistent transfusion practices and weak surveillance systems. For instance, HCV seroprevalence rates as high as 13.5% were reported in Port Harcourt [13] and 18.4% in Uyo [6], and HIV prevalence of 6.3% was noted among SCD patients in Enugu [14]. These figures contrast sharply with our current findings, suggesting that recent health system improvements may be yielding measurable benefits for this high-risk population. Additionally, improved public awareness, access to voluntary counselling and testing (VCT) services, and scale-up of the national HIV response may have contributed to the observed absence of HIV infections.

The implications of these findings are encouraging, suggesting a declining trend in transfusion-transmitted infections among Nigerian SCD patients. It remains essential to conduct larger, multicentre investigations to confirm these trends and identify any emerging gaps in transfusion safety, especially in rural or under-resourced settings. Ongoing vigilance, robust screening systems, and integration of viral hepatitis and HIV surveillance into routine SCD care remain critical to sustaining the progress achieved.

Overall, our results underscore the importance of sustaining and scaling up effective HBV prevention strategies, particularly childhood vaccination and stringent blood screening. Continued monitoring and expanded multicentre studies are warranted to validate these findings and guide policy development aimed at reducing HBV transmission in high-risk groups.

Limitations

The zero-prevalence of Hepatitis C and HIV

infections in this cohort should be interpreted cautiously due to the limited sample size and single-centre scope of the study

CONCLUSION

The prevalence of hepatitis B surface antigen (HBsAg) among sickle cell disease (SCD) patients in Zaria was relatively low at 1.9%, and no cases of HIV or HCV were detected in the study population. These findings suggest a positive impact of improved blood screening protocols, hepatitis B vaccination programs, and enhanced infection control practices. No significant associations were observed between HBsAg status and history of blood transfusion, bone pain crises, or hospitalizations.

Recommendations

These findings underscore the need to sustain and expand current preventive strategies Larger multicentre studies are recommended to confirm these observations and inform regional public health interventions.

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Conflict of Interest: Nil