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# Seroprevalence of transfusion transmissible infections among sickle cell anemia patients in Jos, North Central Nigeria

E D Jatau, O J Egesie, O D Damulak, A Oyekemi, J Jasini, C N Okeke, Z Ayuba, O A Adeyemi, E A Akor, U G Egesie

## ABSTRACT

**Aims:** This study was aimed at determining the seroprevalence of some common transfusion transmissible viral infections in sickle cell anemia patients attending our adult hematology clinic for qualitative management. **Methods:** A total of 111 sickle cell anemia patients attending the Hematology Outpatient Clinic (HOPC) of the Jos University Teaching Hospital (JUTH) in steady state were enrolled consecutively in this cross-sectional study irrespective of their blood transfusion status. Relevant demographic information and clinical histories were obtained using a structured questionnaire after obtaining informed consent from the subjects. Ethical approval was also obtained from the Institutions Human Research Ethics Committee. Blood sample was collected for complete blood count using a 3-part Sysmex hematology autoanalyzer, confirmatory hemoglobin electrophoresis and viral antigen/antibody screening using ELISA kits. Data was analyzed using Epi Info version 7.2.0.1 and Microsoft Office Excel version 2010. **Results:** Majority of our subjects were within the age range of 18–30 years, 48 (43.2%) males and 63 (56.8%) females. Seventy-six (68.5%) had blood transfusion while 35 (31.5%) never had blood transfusion in their life. Seroprevalence of human immunodeficiency virus (HIV), hepatitis B virus (HBV), and hepatitis C virus (HCV) among the transfused sickle cell anemia patients in this study was 7.9% for HIV, 22.4% for HBV, and 15.8% for HCV while those not transfused had seroprevalence of 8.6% for HIV and 11.4% for both HBV and HCV, respectively. No statistically significant difference was observed between those transfused and those who have not had blood transfusion in their life. **Conclusion:** Seroprevalence of transfusion transmissible viral infections was relatively high and blood transfusion did not significantly influence the rate of these viral infections in our sickle cell anemia patients. Improved blood screening techniques, provision of antiviral medications, and vaccines at affordable cost are advocated.

**Keywords:** Jos, Seroprevalence, Sickle cell anemia, Transfusion transmissible infections

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## INTRODUCTION

Sickle cell anemia (SCA) is an inherited red blood cell (RBC) disorder caused by the presence of two abnormal hemoglobin S genes [1]. It occurs due to genetic mutation

as a result of a single nucleotide substitution (GTG for GAG) in the gene for beta globin polypeptide chains on chromosome 11 [1]. Deoxygenation of the hemoglobin S leads to sickling of the RBCs making them more fragile and subject to hemolysis, hence anemia occurs [1]. Anemia of varying degrees becomes apparent in individuals with sickle cell anemia at three to six months after birth making blood transfusion an integral component of the management of acute and chronic complications of sickle cell anemia [2].

Sickle cell anemia is predominantly an inherited disease of Africans, Indians, and Arabians [3]. It is estimated that the incidence of sickle cell anemia in sub-Saharan Africa ranges between 1% and 2% with Nigeria among the countries having the largest burden [3]. Sickle cell trait frequency is as high as 25–30% in West African countries while 1 in 12 African-Americans have the trait [3, 4]. In the absence of early diagnosis, education and preventive therapies, severe anemia due to hemolysis, acute splenic sequestration, aplastic crisis, and multi-organ failure is the commonest cause of death in individuals with sickle cell anemia [4]. Therefore, blood transfusion as a supportive measure has become a major component of the treatment modalities for patients with sickle cell anemia. It is useful for optimizing hemoglobin concentration when below steady state due to their chronic hemolysis or required in periods of severe physiologic stress like major surgeries or critical illnesses among several other indications [5].

Risk of transfusion transmissible infections (TTIs) is therefore a matter of concern especially in resource limited environment like ours where screening of donated blood is rarely at its optimal. One of the commonly encountered TTIs in our environment is HIV infection with an estimated 74.9 million people infected worldwide and 32 million deaths from its immune deficiency syndrome related illnesses since its global epidemic [6]. Some others are hepatitis B and C viral infections known to be associated with chronic liver disease and hepatocellular carcinoma [7]. The global burden of hepatitis made the World Health Assembly in 2016 approve a global strategy for the elimination of viral hepatitis by the year 2030 [8]. This study is for the purpose of determining the seroprevalence of these common blood transfusion transmissible viruses among adult sickle cell anemia patients attending the HOPC of the JUTH. It will form the basis for the follow-up of our patients against some long-term complications of these viral infections like chronic liver disease and hepatocellular carcinoma among others as well as serve as an advocacy tool for better screening methods in blood transfusion services in our environment.

## MATERIALS AND METHODS

This descriptive cross-sectional study was conducted at the HOPC of the JUTH, Jos, between November 2014 and August 2015. The JUTH serves as a referral center to Benue and Nassarawa States as well as Taraba State in North Eastern Nigeria. Approval was obtained from the Human Research Ethics Committee of JUTH, Jos. Written informed consent was obtained from the study subjects after explaining to them the aims, scope, and methodology of the study with the right to abstain without any punitive consequences. The patients recruited irrespective of their transfusion status were from ages eighteen (18) years and above. Those who could not understand the nature of the study, refuse consent or have some other hematologic disorders were excluded from the study.

Relevant information that includes biodata like age, sex, occupation, and marital status were obtained from all consenting subjects. History of previous blood transfusion, when, where, and number of blood units transfused were obtained. Physical examination was carried out and 4 mL of blood sample was collected into an EDTA blood sample bottle for full blood count (FBC) using the 3-part Sysmex hematology autoanalyzer and hemoglobin electrophoresis using the cellulose acetate method to confirm their hemoglobin status. Three milliliters of blood collected into a plain sample bottle and allowed to clot was centrifuged at 5000 rpm for 5 minutes to obtain serum which was stored at –20 °C until analysis. Enzyme-linked immunosorbent assay (ELISA) Kits from Green Screen™ Bio Rad Laboratories, Marnes-la-Coquette, France was used to screen for HIV I & II antigen–antibody, HBV surface antigen, and HCV antigen–antibody. The samples were analyzed according to manufacturers' standard operating procedures with positive and negative controls to ensure accuracy and precision.

Data obtained was analyzed using Epi Info version 7.2.0.1 (Epi Info™, Atlanta, Georgia, USA) and Microsoft Office Excel version 2010. Categorical variables were expressed in frequencies and proportions while Chi-square ($\chi^2$) was used to test association between them. Nonuniformly distributed continuous variables were reported as median with interquartile range (IQR). Statistical significance was set at p-value <0.05.

## RESULTS

One hundred and eleven (111) subjects were recruited within the period of this study. Among them 88 (79.3%) were within ages 18–30 years. Males were 48 (43.2%) of the study subjects while 63 (56.8%) were females. Thirty-five (31.5%) of the subjects had no history of transfusion while 76 (68.5%) were transfused variable units of blood at some point of their life with a median of 1 unit and interquartile range of 0–3. Nine (8.1%) of the study subjects were seropositive to HIV while 102 (91.9%) were HIV negative. Hepatitis B virus antibodies were detected in 21 (18.9%) of the subjects while antibodies to Hepatitis C were detected in 16 (14.7%) of all the subjects (Table 1).

Table 1: Profile of the study subjects

| | n = 111 (%) |
|---|---|
| **Sex** | |
| Male | 48 (43.2) |
| Female | 63 (56.8) |
| **Age** | **n (%)** |
| <18 | 1 (0.9) |
| 18–30 | 88 (79.3) |
| 31–40 | 16 (14.4) |
| 41–50 | 4 (3.6) |
| >50 | 2 (1.8) |
| **Marital status** | |
| Single | 90 (81.1) |
| Married | 16 (14.4) |
| Separated | 3 (2.7) |
| Divorced | 1 (0.9) |
| Widow | 1 (0.9) |
| **Transfusion status** | |
| Transfused | 76 (68.5) |
| Not transfused | 35 (31.5) |
| Number of blood units transfused: median (IQR*) | 1 (0–3) |
| **Transfusion transmissible viral infection status** | |
| **Human immunodeficiency virus (HIV)** | |
| Negative | 102 (91.9) |
| Positive | 9 (8.1) |
| **Hepatitis B virus (HBV)** | |
| Negative | 90 (81.1) |
| Positive | 21 (18.9) |
| **Hepatitis C virus (HCV)** | |
| Negative | 95 (85.6) |
| Positive | 16 (14.4) |

IQR*: Interquartile range.

Human immunodeficiency virus antibodies were detected in 6 (7.9%) of the transfused subjects while those not transfused but had HIV antibodies in their serum were 3 (8.6%). Seventeen (22.4%) and 12 (15.8%) of the transfused subjects in this study tested positive for the HBV and HCV antibodies respectively compared to 4 (11.4%) for both hepatitis viruses in those not transfused any blood unit. No statistically significant difference in seroprevalence in relation to transfusion status for all the transfusion transmissible viral infections studied was established, p-value 0.90, 0.17, and 0.54 (Table 2).

## DISCUSSION

Seroprevalence of HIV, one of the common and dreaded TTIs among the transfused sickle cell anemia subjects in our study was 7.9% compared to 8.6% in those not transfused. This prevalence is comparable to previous report among blood donors in Jos but higher than the Nigerian national prevalence of 2.9% reported in 2016 and also the prevalence among same subjects reported in Zaria and Ile-Ife, Nigeria [9–12]. The marker of a probable flawless system is the HIV prevalence of 0% reported among transfused sickle cell disease (SCD) patients at the Howard University in United States of America (USA) [13]. These marked differences may not be unconnected with the sample size used for these studies, quality of health care services as is likely the case with the Howard University as well as the screening methods employed considering the fact that fourth generation ELISA was used in this study compared to the previous rapid screenings that was the order of the day in our environment. Other factors responsible for the transmission of this virus cannot be ruled out as majority of our subjects were single and fall within the sexually active age group predispose to a number of negative behaviors like parenteral drug use and tattooing.

Hepatitis B and C have been identified as highly contagious viral infection with serious consequences that include liver failure, liver cirrhosis, and hepatocellular

Table 2: Seroprevalence of viral antibodies and transfusion status

| Transfusion status | Negative n (%) | Positive n (%) | Total | p-value |
|---|---|---|---|---|
| **HIV** | | | | |
| Transfused | 70 (92.1) | 6 (7.9) | 76 | 0.90 |
| Not transfused | 32 (91.4) | 3 (8.6) | 35 | |
| **HBV** | | | | |
| Transfused | 59 (77.6) | 17 (22.4) | 76 | 0.17 |
| Not transfused | 31 (88.6) | 4 (11.4) | 35 | |
| **HCV** | | | | |
| Transfused | 64 (84.2) | 12 (15.8) | 76 | 0.54 |
| Not transfused | 31 (88.6) | 4 (11.4) | 35 | |

HIV: Human immunodeficiency virus; HBV: Hepatitis B virus; HCV: Hepatitis C virus.

carcinoma, hence the need for this study and follow-up of infected subjects [14]. The overall prevalence of HBV in our study is 18.9% while those transfused had a prevalence of 22.4% compared to 11.4% among those not transfused. This prevalence is corroborated by a report among first time volunteer blood donors in Jos and comparable with the HBV prevalence in a Nigerian national survey [15, 16]. The global prevalence of HBV varies from 1% in developed world to more than 8% in some Asian countries implying a higher prevalence among our study subjects [16]. A similar study among SCA patients in Benin, South-South Nigeria, reported a seroprevalence of HBV infection that is much higher than the finding in our study [17]. This wide variation in prevalence compared to our finding may be due to the different laboratory methods used considering the comparable sample size and predominant age groups in both studies. Other factors like increasing sexual exposure and parenteral drug abuse may be responsible for the variable prevalence recorded. Prevalence of HBV among our transfused subjects was almost twice of those not transfused implying a possible transmission route in blood transfusion. No remarkable statistical difference was found between those transfused and those who never had even a single unit as supported by several other studies in transfused SCA patients in Nigeria [17, 18]. A closer look at the quality of our blood transfusion screening services, viral hepatitis vaccination, and hepatitis virus infection treatment processes is advocated. Prevalence of HCV among the transfused subjects and those not transfused in our study falls within the range of the national prevalence of 0.4–14.7% comparable with a study in Sokoto, Nigeria but much higher than what was reported among children with sickle cell anemia in Enugu [19–21]. The difference in reported findings across these studies could be multifactorial from population demographics, traditional practices like circumcision and tribal marks, and social risk behaviors to testing methods employed as earlier stated. Worthy of note also is the subnormal immune surveillance associated with SCD in general thus predisposing these patients to wide range of infections including viral hepatitis [22]. Globally, the prevalence of HIV, HBV, and HCV has been on the downward trend and this cannot be separated from the increased public awareness on these infections, high tech diagnostic, screening equipment, availability of antiretroviral and anti-HCV medications, and also vaccination against hepatitis B [23].

## CONCLUSION

Despite the seemingly low transfusion rates among our subjects, the seroprevalence of these transfusion transmissible viral infections was high with no significant relationship with transfusion status. Concerted effort must be put in place to ensure rapid screenings are replaced with more sensitive laboratory techniques. Vaccines and antiviral medications should be made available and affordable for such vulnerable patients while hemovigilance machinery should be instituted with the intent of identifying those with any of these viral infections or associated complications. This will enable early referral to the infectious disease physician and gastroenterologist for better management outcome. We advocate a large population study exploring other possible transmission routes for these viral infections in same subjects irrespective of their age.

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## Author Contributions

E D Jatau – Conception of the work, Design of the work, Acquisition of data, Analysis of data, Interpretation of data, Drafting the work, Revising the work critically for important intellectual content, Final approval of the version to be published, Agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved

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Authors declare no conflict of interest.

## Data Availability
All relevant data are within the paper and its Supporting Information files.