Original Article

Prevalence and Factors Associated with Parvovirus B19 Infection among Blood Donors: A Hospital-Based Study in South-West, Nigeria

Ipeola P. Awolesi[1], Sarah O. John-Olabode[2], Gbenga Olorunfemi[3], Iwuchukwu O. Ajie[4], Olufemi A. Oyedeji[2], Alani S. Akanmu[2]

[1]Lagos State Primary Healthcare Board, Departments of [2]Haematology and Blood Transfusion and [4]Clinical Pathology, College of Medicine, University of Lagos, Lagos, Nigeria, [3]Division of Epidemiology and Biostatistics, School of Public Health, University of Witwatersrand, Johannesburg, South Africa

Abstract

Background: Parvovirus B19 (B19V) is a transfusion transmissible infection that can result in severe consequences in vulnerable population that includes pregnant women, immunocompromised and chronic hemolytic anemia patients. The aim of this study was to determine the prevalence and factors associated with B19V infection amongst blood donors in South–West Nigeria. **Materials and Methods:** We conducted a comparative cross-sectional study to determine the seroprevalence of B19V immunoglobulin M (IgM) antibody among 183 blood donors at the blood bank of a tertiary hospital. The results were analyzed with SPSS 23 software, prevalence and associated factors were determined using frequencies and logistic regression, respectively. **Results:** The prevalence of B19V IgM was 7.1% (95% confidence interval: 4–11) with a higher prevalence among male donors compared to females (84.6% vs. 15.4%, $P = 0.54$). There was a statistically significant difference in the seropositivity of B19V IgM amongst the ethnic groups with the Yoruba ethnic group having a higher proportion of B19V IgM-positive participants $P = 0.04$. Ethnicity, gender, and steady employment were also associated with increased odds of infection, while increasing age appeared to be protective; though none of these factors were statistically significant. **Conclusion:** This study has shown that there is still high exposure to transfusion transmissible B19V infection.

Keywords: Blood donor, parvovirus immunoglobulin M antibody, sickle cell anaemia

Introduction

Emerging infections such as parvovirus B19 (B19V) have properties indicating the potential to be transmitted through blood transfusion.[1-6] The modes of transmission of B19V are varied and these include respiratory secretions, other routes include vertical transmission from the mother to the fetus and through transfusion of B19V-infected blood.[7-14]

B19V infection has been closely linked with transient red cell aplasia in patients' with sickle cell anemia (SCA)[15-19] B19V infection in pregnant women has also been implicated as a cause of hydrops fetalis and intrauterine fetal death.[6,20] Thus, there is need to produce protocols for preventing transfusion transmissible B19V infection. This study was aimed at determining the prevalence of B19V infection amongst blood donors in Ogun State, Nigeria.

Access this article online

Quick Response Code:

Website: www.njmonline.org

DOI: 10.4103/NJM.NJM_6_20

Materials and Methods

We conducted a comparative cross-sectional study among eligible blood donors at the donor's clinic of Olabisi Onabanjo University Teaching Hospital (OOUTH), Ogun State from February to October 2019. All the donors that participated in this study gave a written informed consent and the study was approved by the Health and Research Ethical Committee of OOUTH (number NHREC/28/11/2017). This study was

Address for correspondence: Dr. Sarah O. John-Olabode, Department of Haematology and Blood Transfusion, College of Medicine, University of Lagos, Lagos, Nigeria.
E-mail: sjohn-olabode@unilag.edu.ng

How to cite this article: Awolesi IP, John-Olabode SO, Olorunfemi G, Ajie IO, Oyedeji OA, Akanmu AS. Prevalence and factors associated with parvovirus B19 infection among blood donors: A hospital-based study in South-West, Nigeria. Niger J Med 2020;29:203-7.

Submitted: 14-Feb-2020 **Revised:** 27-Feb-2020
Accepted: 08-Apr-2020 **Published:** 26-Jun-2020

performed in accordance with the ethical standards laid down in the 1964 Declaration of Helsinki and its later amendments. Sociodemographic, donation history, and medical history data were collected from study participants using interviewer administered questionnaire. Thereafter, 5 ml of venous blood was obtained from donors and dispensed into an anticoagulant-free sample bottle. The sample was centrifuged within an hour of collection for 10 min at 3000 rpm to obtain serum. The serum was separated into anticoagulant-free bottle and stored at −20°C until time for analysis.

B19V immunoglobulin M (IgM) was assayed using Melsin enzyme-linked immunosorbent assay (ELISA) kit manufactured by Melsin Medical Co., Ltd-Changchun, China. The assay was carried out according to the manufacturer's instruction. The result was considered negative if optical density (OD) of sample was less than the cutoff. The result was considered positive if the OD of sample was ≥ the cutoff. The cutoff calculation was the absorbance value of negative control wells +0.15.

Data were analyzed using SPSS software version 23.0 (Statistical Product and Service Solutions, Inc. Chicago, Illinois, USA). Categorical data were summarized using frequency and percentages while continuous variables were described using the mean and standard deviation or median and interquartile range. Pearson's Chi-square (or Fisher's exact) test was used to test for the association between categorical variables and the B19V infection status. Binary logistic regression was conducted to evaluate factors associated with the B19V infection positivity. The $P \leq 0.05$ was assumed to be statistically significant.

Results

A total of 183 blood donors were recruited into the study. Table 1 shows the socio demographic characteristics of study participants. The seroprevalence of anti-IgM B19V amongst study participants was 7.1% (95% confidence interval [CI]: 4–11) [Figure 1]; there was a statistically significant difference in the seropositivity of B19V IgM among the ethnic groups with the Yoruba ethnic group having a higher proportion of B19V IgM-positive participants $P = 0.04$ [Table 2]. Although none of the participants had ever received any blood or blood products, 38% of the seropositive participants had a previous history of blood donation [Table 2]. The Yoruba ethnic group had an increased odds (odds ratio = 2.71, 95% CI = 0.65–11.33) of being seropositive for B19V IgM compared to participants from other ethnic groups, though this was not statistically significant $P = 0.22$ [Table 3]. Male gender and steady employment were also associated with increased odds of infection, while increasing age appeared to be protective; though none of these factors were statistically significant [Table 3]. Furthermore, we found none of the positive participants had clinical symptoms of Parvo virus B19 infection as at the time of blood donation [Table 4].

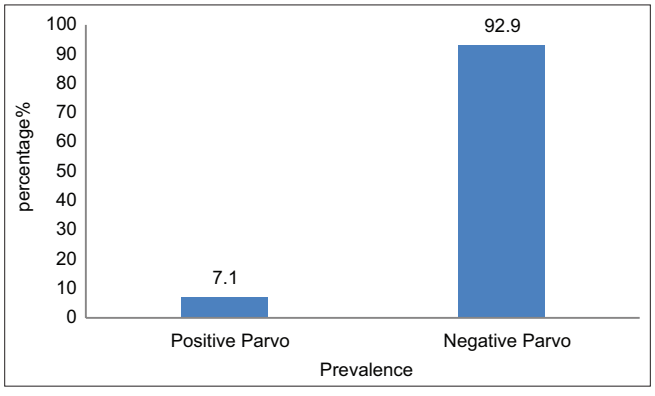

Figure 1: Seroprevalence of parvovirus B19 among blood donors

Discussion

The transfusion of safe blood or blood product is the major goal in transfusion medicine. The transmission of viruses such as hepatitis B, hepatitis C, HIV have reduced over the years due to the global strategy focused on screening these viruses in donated blood. There is renewed interest to the threat posed by emerging infections that occur due to climate and environmental changes or transmigration associated with globalization. Emerging infections such as B19V pose a threat to transfusion safety especially when the donor is in the asymptomatic phase of the infection. In Nigeria, the most common emerging infection of paramount concern is B19V due to high prevalence of SCA in the population.

Table 1: Characteristics of study participants

Variable	Frequency (n=183)	Percentage % (95% CI)
Gender		
Male	164	89.6 (84-93)
Female	19	10.4 (7-16)
Age group (years)		
18-26	41	22.4 (16.90-29.08)
27-35	66	36.1 (29.38- 43.34)
36-43	37	20.2 (14.97-26.73)
44-51	22	12.0 (08.02-17.64)
52-60	17	9.3 (05.83-14.49)
Marital status		
Single	65	35.5 (29-30)
Married	118	64.5 (54-75)
Educational status		
Informal	7	3.8 (2-8)
Primary	35	19.1 (14-26)
Secondary	84	45.9 (39-53)
Tertiary	57	31.1 (23-41)
Occupation		
Unemployed	54	29.5 (23.3-36.6)
Employed	129	70.5 (63.4-76.7)
Ethnicity		
Yoruba	160	87.4 (82-92)
Igbo	13	7.1 (4-12)
Hausa	5	2.7 (1-6)
Others	5	2.7 (1-6)

CI – Confidence interval

Table 2: Sociodemographic characteristics of study participants based on B19V seroprevalence

Characteristics	B19V IgM positive (*n*=13) (%)	B19V IgM negative (*n*=170) (%)	*P*
Gender			
Male	11 (84.6)	153 (90)	0.54
Female	2 (15.4)	17 (10)	
Age group (years)			
18-26	2 (15.4)	39 (22.9)	0.85
27-35	4 (30.8)	62 (36.5)	
36-43	4 (30.8)	33 (19.4)	
44-51	2 (15.4)	20 (11.8)	
52-60	1 (7.7)	16 (9.4)	
Marital status			
Single	3 (23.1)	62 (36.5)	0.28
Married	10 (76.9)	108 (63.5)	
Educational status			
Informal	0 (0)	7 (4.1)	0.26
Primary	0 (0)	35 (20.6)	
Secondary	8 (61.5)	76 (44.7)	
Tertiary	5 (38.5)	52 (30.6)	
Occupation			
Unemployed	6	48	0.17
Employed	7	122	
Ethnicity			
Yoruba	10 (76.9)	150 (88.2)	0.04
Igbo	0 (0)	13 (7.6)	
Hausa	2 (15.4)	3 (1.8)	
Others	1 (7.7)	4 (2.4)	
Previous history of blood donation			
Yes	5 (38.5)	82 (48.2)	0.46
No	8 (61.5)	88 (51.8)	

Table 3: Logistic regression model of associations with B19V IgM seropositivity

Variable	OR (95% CI)	*P*
Age (years)		
18-26	1	
27-35	0.69 (0.12-4.20)	0.69
36-43	0.39 (0.06-2.37)	0.31
44-51	0.49 (0.06-3.85)	0.49
52-60	0.79 (0.06-9.91)	0.86
Ethnicity		
Yoruba	2.71 (0.65-11.33)	0.17
Other ethnic groups	1	
Gender		
Male	2.20 (0.40-12.04)	0.36
Female	1	
Occupation		
Unemployed	1	
Employed	2.53 (0.73-8.84)	0.49

OR – Odds ratio, CI – Confidence interval

In this study, we found a seroprevalence of 7.1% among participants screened for acute B19Vinfection. This result is in accordance with that reported by Kumar *et al*.[21] where a prevalence of 7.53% was obtained among blood donors in India but higher than most previous studies which reported the prevalence of B19V IgM in blood donors or healthy population below 2%, as documented by Iheanacho *et al*., Doyle *et al*. and Muñoz *et al*. who discovered a prevalence of 1.3%, 1%, and 0% among the Nigerian, American, and Spanish blood donors, respectively.[22-24] This increase in seroprevalence most especially when compared with the study of Iheanacho *et al*., which was conducted in a similar study population suggests not enough is being done to prevent active transmission of B19V to blood recipients.

We found a significantly higher seropositivity level ($P = 0.04$) among participants in the Yoruba ethnic group compared to the other ethnic groups. To the best of our knowledge, this finding has not been reported in previous local studies and need to be explored in larger nationwide studies for a plausible reason for this finding. We also found a higher proportion of males' 89.6% (11/13) testing positive for B19V IgM as compared to females 10.4% (2/13) in this study, though not significant is similar to the result obtained by Musa *et al*.[25] This attribute can possibly be explained by the finding of Faddy *et al*.[26] that females appear to have increased immunity to B19V compared to males.

We report reduced odds of B19V IgM seropositivity with increasing age, this finding is in keeping with those of various studies[26-28] who reported an increase in B19V immunity with increasing age among the Nigerian, Indian, and Australian population, respectively. From this study, it can be deduced that 47.5% of the participants had donated blood before and considering the high prevalence of 7.1% obtained from the study this suggests a high likelihood of transfusion transmissible parvovirus infection upon exposure to affected blood products by vulnerable recipients such as sickle cell patients, children, pregnant women, and immunocompromised patients who may later become chronically infected.

Furthermore, noteworthy is the fact that the positive participants were asymptomatic in agreement with the findings from Okojokwu *et al*.,[29] that there is no statistically significant association between symptoms (body rash and joint pains) and B19V. This is quite alarming as it suggests a high probability of continuous active transmission of transfusion transmissible B19V infection.

Key limitations in our study include our small sample size, the usage of only one type of ELISA kit and inability to carry out molecular assay for confirmation; conducting larger multicenter studies will help determine the actual risk of transfusion transmissible B19V in the entire general Nigerian population.

Table 4: Participants' clinical characteristics in relation to Parvo virus infection

Symptoms	B19V IgM positive (*n*=13) (%)	B19V IgM negative (*n*=170) (%)	Total	*P*
Itchiness				
Yes	0 (0)	1 (0.6)		0.78
No	13 (100)	169 (99.4)	183 (100)	
Rash				
Yes	0 (0)	2 (1.2)		0.69
No	13 (100)	168 (98.8)	183 (100)	
Joint pain				
Yes	0 (0)	2 (1.2)		0.69
No	13 (100)	168 (98.8)	183 (100)	
Dizziness				
Yes	0 (0)	1 (0.6)		0.78
No	13 (100)	169 (99.4)	183 (100)	

Conclusion

Although this study showed a low prevalence of B19V IgM it still suggests there is an increased risk of transfusion transmissible B19V infection by vulnerable population that includes pregnant women, immunocompromised, and chronic hemolytic anemia patients. This begs the need for improved hemovigilance in the country.

Acknowledgments

We appreciate the staff of Folabi Medical Center and the blood donation clinic of the Olabisi Onabanjo University Teaching Hospital Ogun State Nigeria who facilitated our recruitment of participants.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

References

1. Niederhauser C, Gottschalk J, Tinguely C. Selective testing of at-risk blood donors for *Trypanosoma cruzi* and *Plasmodium* spp. in Switzerland. Transfus Med Hemother 2016;43:169-76.
2. Alger LS. Toxoplasmosis and parvovirus B19. Infect Dis Clin North Am 1997;11:55-75.
3. Brown KE, Young NS, Alving BM, Barbosa LH. Parvovirus B19: Implications for transfusion medicine. Summary of a workshop. Transfusion 2001;41:130-5.
4. Heegaard ED, Brown KE. Human parvovirus B19. Clin Microbiol Rev 2002;15:485-505.
5. Lefrère JJ, Delmas AS, Candotti D, Mariotti M, Thomas I, Brossard Y, *et al*. Persistent B19 infection in immunocompetent individuals: Implications for transfusion safety. Blood 2005;106:2890-5.
6. Niele AM, Kroes AC. Human parvovirus B19: Relevance in internal medicine. Neth J Med 1999;54:221-30.
7. Servant A, Laperche S, Lallemand F, Marinho V, Maur GD, Meritet JF, *et al*. Genetic diversity within human erythroviruses: Identification of three genotypes. J Virol 2002;76:9124-34.
8. Hokynar K, Venermo MS, Pesonen M, Ranki A, Kiviluoto O, Partio EK, *et al*. A new parvovirus genotype persistent in human skin. Virology 2002;302:224-8.
9. Liefeldt L, Plentz A, Klempa B, Kershaw O, Endres AS, Raab U *et al*. Recurrent high-level parvovirus B19/genotype 2 viremia in a renal transplant recipient analyzed by real-time PCR for simultaneous detection of genotypes 1 to 3. J Med Virol 2005;75:161-9.
10. Nguyen QT, Wong S, Heegaard ED, Brown KE. Identification and characterization of a second novel human erythrovirus variant, A6. Virology 2002;301:374-80.
11. Sanabani S, Neto WK, Pereira J, Sabino EC. Sequence variability of human erythroviruses present in bone marrow of Brazilian patients with various parvovirus B19-related hematological symptoms. J Clin Microbiol 2006;44:604-6.
12. Toan NL, Duechting A, Kremsner PG, Song le H, Ebinger M, Aberle S, *et al*. Phylogenetic analysis of human parvovirus B19, indicating two subgroups of genotype 1 in Vietnamese patients. J Gen Virol 2006;87:2941-9.
13. Norja P, Hokynar K, Aaltonen LM, Chen R, Ranki A, Partio EK, *et al*. Bioportfolio: Lifelong persistence of variant and prototypic erythrovirus DNA genomes in human tissue. Proc Natl Acad Sci USA 2006;103:7450-3.
14. Candotti D, Etiz N, Parsyan A, Allain JP. Identification and characterization of persistent human erythrovirus infection in blood donor samples. J Virol 2004;78:12169-78.
15. Slavov SN, Kashima S, Pinto AC, Covas DT. Human parvovirus B19: General considerations and impact on patients with sickle-cell disease and thalassemia and on blood transfusions. FEMS Immunol Med Microbiol 2011;62:247-62.
16. Young NS, Brown KE. Parvovirus B19. N Engl J Med 2004;350:586-97.
17. Fleming AF, Storey J, Molineaux L, Iroko EA, Attai ED. Abnormal haemoglobins in the Sudan savannah of Nigeria. I. Prevalence of haemoglobins and relationships between sickle cell trait, malaria and survival. Ann Trop Med Parasitol 1979;73:161-72.
18. Nwogoh B, Adewoyin AS, Iheanacho OE, Bazuaye GN. Prevalence of haemoglobin variants in Benin City, Nigeria. Ann Biomed Sci 2012;11:60-4.
19. Bamidele AI, Senapon OI, Semande OH. Seroprevelence of Parvo virus B19 antibodies and evidence of viremia among Nigerian patients with sickle cell anemia. J Biomed Res 2013;7:272-82.
20. Pasquinelli G, Bonvicini F, Foroni L, Salfi N, Gallinella G. Placental endothelial cells can be productively infected by Parvovirus B19. J Clin Virol 2009;44:33-8.
21. Kumar S, Gupta RM, Sen S, Sarkar RS, Philip J, Kotwal A, *et al*. Seroprevalence of human parvovirus B19 in healthy blood donors. Med J Armed Forces India 2013;69:268-72.
22. Iheanacho MC, Akanmu SA, Nwongoh B. Sero prevalence of parvovirus B19 antibody in blood donors and sickle cell disease patients at Lagos University Hospital (LUTH): A comparative study. Afr J Cln Exper Microbiol 2014;15:14-20.
23. Doyle S, Kerr S, O'Keeffe G, O'Carroll D, Daly P, Kilty C. Detection of parvovirus B19 IgM by antibody capture enzyme immunoassay: Receiver operating characteristic analysis. J Virol Methods 2000;90:143-52.
24. Muñoz S, Alonso MA, Fernández MJ, Muñoz JL, García-Rodríguez JA. Seroprevalence versus Parvovirus B19 in blood donors. Enferm Infecc Microbiol Clin 1998;16:161-2.

25. Musa SA, Banwat EB, Zhakom P, Rumji EM, Yakubu RK, Rufai OA. Risk of transfusion-transmitted human parvovirus B19 infection in Anyigba and Lokoja, Kogi State – Nigeria. IOSR J Pharm 2013;3:66-70.
26. Faddy HM, Gorman EC, Hoad VC, Frentiu FD, Tozer S, Flower RLP. Seroprevalence of antibodies to primate erythroparvovirus 1 (B19V) in Australia. BMC Infect Dis 2018;18:631.
27. Viswanathan R, Tandale BV, Tamayachekar MS, Jadhav SM, Khutwad KA, Munne KR. Seroepidemiology of parvovirus B19 among different age groups pregnant women in India. Indian J Med Res 2017;146:138-40.
28. Emiasegen SE, Nimzing L, Adoga MP, Ohagenyi AY, Lekan R. Parvovirus B19 antibodies and correlates of infection in pregnant women attending an antenatal clinic in central Nigeria. Mem Inst Oswaldo Cruz 2011;106:227-31.
29. Okojokwu OJ, Adebayo MB, Abubakar BS, Yusuf IA, Okopi JA. Seroepidemiology of human parvovirus B19 infection among pregnant women in Abuja, Nigeria. Host Viruses 2018;5:57-62.