

ABO/Rh BLOOD GROUPS AND RISK OF HIV INFECTION AND HEPATITIS B AMONG BLOOD DONORS OF ABIDJAN, CÔTE D'IVOIRE

Liliane Kouabla Siransy^{1,*}, Zizendorf Yves Nanga^{2,3}, Flore Sandrine Zaba⁴, Nyasenu Yawo Tufa⁵, Sery Romuald Dasse¹

¹Immunology–Allergology Department, UFR Medical Sciences, Felix Houphouet Boigny University, Abidjan, Côte d'Ivoire

²Faculty of Pharmaceutical and Biological Sciences, Felix Houphouet Boigny University, Abidjan, Côte d'Ivoire

³National Public Health Laboratory, Abidjan, Côte d'Ivoire

⁴Bacteriology–Virology Department, Central Laboratory of the University Hospital of Yopougon, Côte d'Ivoire

⁵Laboratory of Microbiology – CNR/HIV, University Hospital Sylvanus Olympio, Togo

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Hepatitis B and HIV infection are two viral infections that represent real global public health problems. In order to improve their management, some hypotheses suggest that genetic predispositions like ABO and Rh blood groups would influence the occurrence of these diseases.

The aim of the present study was to examine the association between ABO and Rhesus blood groups and the susceptibility to HIV infection and hepatitis B.

We conducted a cross-sectional and analytical study in a population of voluntary blood donors in the Blood Transfusion Center of Abidjan. All blood donors who donated blood between January and June 2014 were tested for HBs antigen and anti-HIV antibodies (ELISA tests) and were ABO typed.

The total number of examined blood donors during this period was 45,538, of which 0.32% and 8.07% were respectively infected with HIV and hepatitis B virus. O-group donors were more infected than non-O donors.

Our study is an outline concerning the search for a link between ABO and Rh blood groups and hepatitis B and HIV infection. Further studies should be conducted to confirm the interaction between these two infections and contribute to the search for new therapeutic approaches.

Keywords: ABO blood group, Rh blood groups, HIV infection, hepatitis B, blood donors, Côte d'Ivoire

Introduction

AIDS pandemic has become in the space of 20 years a real development problem for almost all African countries because it affects the most active age group of the population (15–49 years) [1]. With over 34 million deaths to date, HIV continues to be a major public health problem. In 2014, 1.2 million people died of HIV-related causes in the world. Sub-Saharan Africa is the most affected region with almost 70% of new infections. The prevalence in Côte d'Ivoire was 3.7% in the general population [2].

Moreover, despite the existence of an effective vaccine, hepatitis B also remains a global public health problem, with more than 350 million people with chronic hepatitis and about 1 million deaths annually [3]. Côte

d'Ivoire, with a prevalence of HBs antigen estimated at over 10% in the general population, is at a level of high endemicity [4].

Hepatitis B and HIV infection having the same modes of transmission, both infections are favored by various risk factors. Indeed, some evidence suggests that genetic factors like ABO and Rh blood groups would influence the occurrence of these viral infections.

With the discovery of blood groups by Landsteiner and subsequent great advancement in its study, many workers have tried to find out a possible relationship between the incidence of these blood groups and the incidence of various diseases [5]. Thus, a strong association has been described between peptic ulcer disease and blood group O; between stomach cancer, pernicious anemia, diabetes

* Corresponding author: Liliane Kouabla Siransy; Immunology–Allergology Department, UFR Medical Sciences, Felix Houphouet Boigny University, Abidjan, Côte d'Ivoire; Phone: (225) 01 05 07 34; E-mail: lilianesiransy@yahoo.fr

mellitus and blood group A [6]; and between hepatocellular carcinoma and blood group A [7]. A study in Nigeria in 2015 also proved the existence of a link between asthma and blood group A [8]. In the field of dermatology and venereology, potential associations have also been shown between lichen planus and blood group A, pemphigus and seborrheic dermatitis and blood group B, and vitiligo and blood group AB [5].

The association between hepatitis B or HIV infection and ABO has also been the subject of some publications [9, 10].

However, no data on this association is available in Côte d'Ivoire. Considering the lack of studies addressing this issue, the aim of the present study was to analyze the frequency of HIV infection and hepatitis B and the odds of being infected in a population of blood donors according to donors' ABO blood group antigen and antibody profile.

Blood donors are ideal for this purpose, as all donors are routinely subjected to ABO blood group antigen and antibody typing and laboratory tests to detect these two infections [11].

Materials and methods

This study was part of prospective investigations on ABO and Rhesus blood groups at the Blood Transfusion Center in Abidjan (the economic capital of Côte d'Ivoire). This town is one of the largest and most populous cities of Côte d'Ivoire, between 500 miles and one million inhabitants. It was a cross-sectional and analytical study that was conducted from January to June 2014. The study was approved by the local ethical committee.

Study population

All voluntary blood donors (old and new donors) underwent clinical evaluation, which excluded individuals at risk for sexually transmitted diseases, drug use, anemia, infection, fever, or chronic diseases. Multitransfused people, donors with an age outside acceptable limits (18–65 years), with low weight (≤ 50 kg), lactating women, and menstruating or pregnant women were also excluded.

Socio-demographic characteristics of selected blood donors were centralized in the database (PROGESA; MAK; Computer Version 14; France) of the Blood Transfusion Center. Blood donors were divided into new donors and regular donors. New donors were voluntary blood donors who had accumulated less than two (2) blood donations until the first half of 2014. Regular donors were those who had a number of donations higher or equal to two (2) during the same period.

Laboratory analysis

Serology of blood donors

All collected blood donations were tested for HBs antigen and anti-HIV antibodies.

- HIV seropositivity was tested on blood donors sera, using HIV Ab/Ag ELISA Kit (DIA.PRO, Italy), enzyme immunoassay test for the detection of anti-HIV1, anti-HIV2, anti-HIV1 group O antibodies, and P24 antigen of HIV1; as per manufacturer's manual; and Genie III for HIV typing.

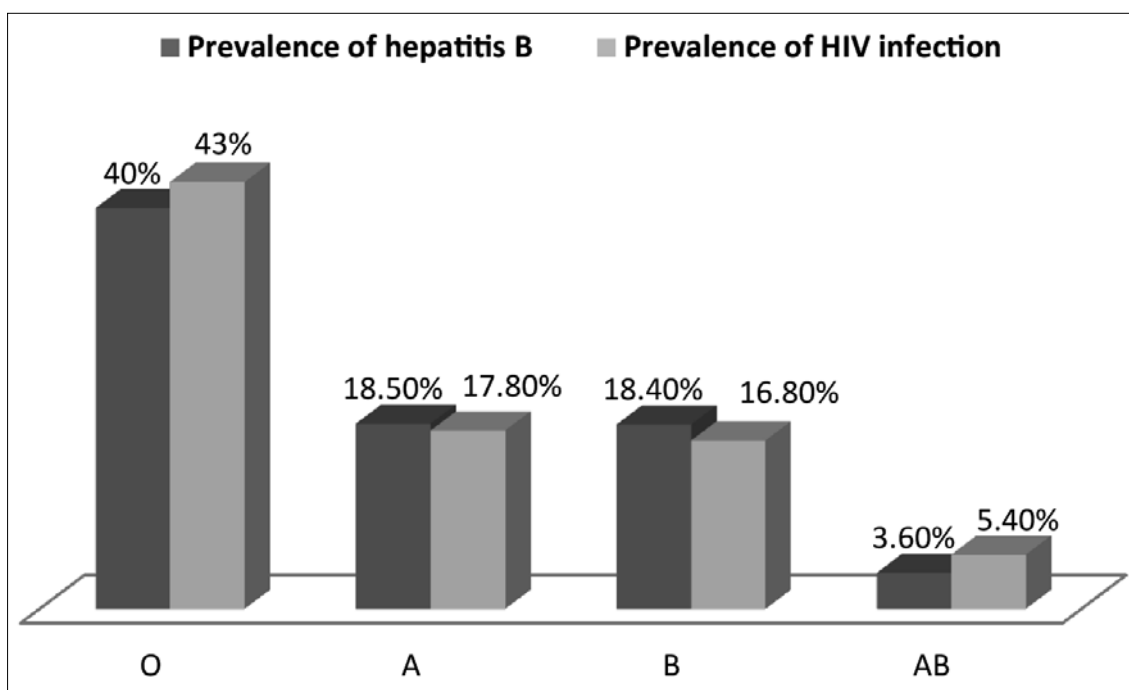


Fig. 1. Distribution of blood donors infected with HIV and hepatitis B virus according to blood groups

– HBs antigen detection was performed by technical enzyme immunoassay of “sandwich” type, using the ELISA HBs Antigen Ultra Kit (DIA.PRO, Italy).

ABO and Rhesus blood grouping

ABO and Rhesus blood grouping were performed simultaneously with reagents (anti-A, anti-B, anti-AB, and anti-D) from Diagast Laboratory. Red blood cell agglutination method was used for analysis of blood groups. Both Beth Vincent globular test and Simonin–Michon plasmatic test were used.

Statistical analysis

The data derived from this study were analyzed using Excel[®] software and Epi Info version 6.0. Odds ratios (OR) for and against hepatitis B and HIV infection based on ABO and Rhesus blood groups and the respective 95% confidence interval (CI) for blood groups were estimated.

lection sites were predominantly schools and vocational training, followed by hospitals and health facilities.

The age group from 25 to 44 years was the most represented, with a predominance of male donors (sex ratio: 4.79). The incidence of blood group A, B, AB, and O was found to be 22.51%, 23.53%, 4.40%, and 49.74%. The incidences of Rh-positive and Rh-negative blood groups were found to be 97% and 3%. Hepatitis B was the infection most found among blood donors (8.07%). 0.32% of donors were infected with HIV, with a predominance of HIV type 1 (73.76%).

The highest frequencies of infected donors (hepatitis B and HIV infection) were observed in blood group O (Fig. 1).

In our study, ABO blood groups did not increase the risk of developing hepatitis B (Table 1). Also, there was no statistical association between ABO blood groups and HIV infection (Table 2). In addition, the Rh system had no effect on HIV infection and hepatitis B (Table 3). However, the highest frequencies of these infections were observed in Rh positive.

Table 1. Influence of ABO blood groups on HBs serology

	HBs Ag +	HBs Ag –	OR	IC (95%)	P
O	2,044	27,578	0.99	[0.13–1.05]	0.17
Others (A, B, AB)	2,075	27,630			
A	947	12,299	1.04	[0.96–1.12]	1.13
Others (O, B, AB)	3,172	42,909			
B	941	12,943	0.99	[0.92–1.07]	0.09
Others (O, A, AB)	3,178	43,206			
AB	187	2,575	0.98	[0.84–1.14]	0.1
Others (O, A, B)	3,932	52,820			

Table 2. Influence of ABO blood group on HIV status

	HIV +	HIV –	OR	IC (95%)	P
O	86	29,536	1.04	[0.77–1.41]	0.06
Others (A, B, AB)	83	29,622			
A	36	13,206	0.96	[0.66–1.39]	0.06
Others (O, B, AB)	131	45,950			
B	34	13,850	0.82	[0.56–1.19]	1.02
Others (O, A, AB)	135	45,308			
AB	11	2,564	1.54	[0.83–2.84]	1.92
Others (O, A, B)	158	56,594			

Table 3. Influence of Rh system on HBs serology

	HBs Ag +	HBs Ag –
Rh positive	7,217	80,984
Rh negative	490	6,025
Total	7,707	87,009

Results

The total number of voluntary blood donors was 45,538, of which 26,965 were new donors and 18,573 were regular donors. A total of 73,398 donations were recorded during our study period, with 63% from regular donations. Col-

Discussion

The Blood Transfusion Center is the structure in charge of the transfusion activity in Côte d'Ivoire. Its main mission is to ensure the adequate supply of the whole country in blood products while ensuring blood safety. Blood transfusion is only possible with blood donations. Indeed, giving blood is an act of generosity and solidarity that is saving every year thousands of lives.

Donations recorded during our study period at the Blood Transfusion Center of Abidjan were mainly from regular donations. This loyalty of blood donors in the donation has multiple reasons: firstly, save lives and also enjoy the benefits of regular blood donors.

Volunteer blood donors in our series were relatively young. This result is superimposed on that obtained in a study in Côte d'Ivoire in 2013 [12], where blood donors of the blood transfusion center of Abidjan were also dominated by this age of the population (30–39 years). This predominance of young people seems to be related to increased awareness of the blood transfusion center on the importance of blood donation in Côte d'Ivoire.

Males were highly prevalent in our study with a sex ratio of 4.79. This result is corroborated by other studies. Thus, in a study in the blood transfusion center of Bouaké, in Côte d'Ivoire in 2001 [13], blood donors were mostly male (sex ratio: 2.75). In addition, a study in the blood transfusion center in Abidjan in 2013 [12] reported a sex ratio of 2.19 in favor of men. This predominance of male donors could be due to the different contraindications of blood donation among women: pregnant women, nursing or menstruating.

In our study, blood donors were mostly of blood group O and Rh positive. Our results are superimposed with those of a 2009 study on phenotypic and genotypic frequencies of ABO and Rh systems in the Ivorian population [14]. The authors had reported frequencies of blood group A: 22.6%, B: 22.12%, AB: 3.94%, O: 51.27%, Rh positive: 93.30%, and Rh negative: 6.70%.

In endemic high-prevalence countries such as Côte d'Ivoire, certain viral infections including hepatitis B and HIV infection pose a serious threat in blood recipients. Thus, in order to ensure universal access to safe blood and blood products, WHO recommends routine screening for transfusion-transmissible infections with quality assurance in all blood donations before their use. The prevalence of these infections in blood donations in high-income countries is significantly lower than in low- and middle-income countries [13]. Thus, in our study, the seroprevalence of HIV infection and hepatitis B was 0.32% and 8.07%, respectively. This is confirmed by the work of Assi et al. in 2011 [15], who have reported a prevalence of 8% of HBs antigen in Abidjan. Hepatitis B was the infection most found. Ehoussou [16] found a slightly higher rate (12.5%) in military blood donors. These rates reflect the high endemicity of hepatitis B in the population of blood donors. It confirms that of the general population in Côte d'Ivoire. Since HBs antigen is the principal marker sought for the

diagnosis of hepatitis B among blood donors, it would make sense to add other markers of infection for screening (for example, to detect occult infections). These results are lower than those of the regional blood transfusion center of Koudougou in Burkina Faso [17] that reveal rates of 2.21% and 14.96%, respectively, for HIV infection and hepatitis B.

However, the low prevalence of HIV infection in our study could be justified by a rigorous selection to remove blood donors with infectious risk factors.

Furthermore, our study showed no correlation between ABO blood groups and hepatitis B, and between ABO blood groups and HIV infection.

Our results are consistent with those of Emeribe and Ejezie [10], who found no significant association between ABO blood group distribution and the presence of HBs antigen (P greater than 0.05). Also, a study in Australia in 1971 [9] showed that, when the sample size was large enough, there was no difference in the distribution of ABO blood groups among HBs antigen carriers and noncarriers.

However, the highest prevalence of hepatitis B and HIV infection was found in group O blood donors, as confirmed by the work of Emeribe and Ejezie [10], who reported a higher prevalence of HBs antigen in donors of group O (4.3%) against the 0% frequency for group AB donors. Our results are also stackable with those of a study conducted in Liverpool [18] during a circumscribed outbreak of hepatitis B among patients and staff of a hemodialysis unit, where a disproportionate excess of group O was found. This suggests that host factors may be important in the genesis of the disease.

Furthermore, in the study of Sayal in 1996 [5] about subjects of the armed forces, a relatively increased incidence of HIV infection was observed in persons with blood group O and relatively lower incidence in blood group B. Incidence of HIV infection was also low in Rh-negative subjects. These results suggest a possible relationship between the incidence of blood group and the natural defense mechanism against HIV infection. The level of natural antibodies in humans may be different in different ABO blood groups. One would assume that those in group B would have a higher degree of natural resistance against HIV while those of group O have a lesser degree of this natural resistance.

However, results contrary to ours were reported in other studies. Thus, Zuckerman and McDonald [19] found an excess of group A and a corresponding deficit of group O in 378 cases of acute hepatitis during a probable outbreak of hepatitis B in the British Air Force. Moreover, a study conducted in 2013 on Brazilians infected with HIV [11] revealed that the highest proportion of people infected with HIV has been observed in those of blood group B. The lowest proportion was observed in groups A and O.

One explanation for the low prevalence of blood group O in these two studies is given by Dr. Heinrich Kremer. According to him, patients belonging to blood group B, A, and AB would present the highest risk of developing a freely convertible protons deficiency or systemic diseases.

They would be more willing to Th1–Th2 switches in favor of Th2, compared to O blood group donors. The advantage would be a better antibody production and the drawback would be a decreased cellular immunity. This would result in greater susceptibility to transition to seropositivity [20].

Conclusion

Our study revealed no association between ABO and Rh blood groups and viral infections (hepatitis B and HIV infection). However, the highest frequency of infected donors was observed in blood group O. It would be advisable to conduct further studies to confirm the link between these two parameters in Côte d'Ivoire, to identify the mechanisms by which ABO antigens may influence the occurrence of these two viral infections, and to contribute to the search for new therapeutic approaches. Furthermore, the high frequency of hepatitis B observed in our study could be lowered by raising awareness of vaccination against hepatitis B among blood donors.

Conflicts of interest

The authors declare that they have no conflicts of interest.

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