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Seroprevalence of Viral Hepatitis B and C and HIV Co-Infection among Voluntary Blood Donors in the Northern Region of Burkina Faso

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Abstract

The aim of this study was to assess the seroprevalence of viral hepatitis B and C and co-infection with HIV among volunteer blood donors at the blood sampling and distribution depot (BSDD) in Ouahigouya. Patients and methods: Our study population consisted of all volunteer blood donors who had donated during a 2-year period from 1 January 2019 to 31 December 2020. Samples were taken from patients with no contraindications and serological tests were performed using ELISA tests. HBsAg, HCV-Ac and HIV serology were tested. All samples reactive for HIV, HBV and HCV were retested for confirmation using a second enzyme-linked immunosorbent assay. A result was considered positive if both the first and second tests were positive. Results: In two years, the Ouahigouya BSDD recorded 9726 donations, including 7983 new donors and 1743 former donors. The average age of donors was 25.59 years, with a sex ratio of 3.4. The seroprevalence of HBV, HCV and HIV was 7.31%, 3.10% and 2.12% respectively. HBV-HCV co-infection was found in 0.32% of cases, HIV-HBV, HIV-HCV, and HIV-HBV-HCV co-infection were found in 0.25%, 0.09% and 0.04% respectively. Conclusion: The seroprevalence of viral hepatitis B and C remains high among volunteer blood donors in Ouahigouya, although a decline in seroprevalence appears to be on the horizon.

Keywords

Viral Hepatitis B and C, HIV, Co-Infection, Volunteer Blood Donors

1. Introduction

Viral hepatitis is a worldwide public health problem. In 2019, there were almost 296 million chronic hepatitis B virus carriers (3.8%) worldwide and 56 million chronic hepatitis C carriers (0.8%) according to some estimations [1]. Burkina Faso has a seroprevalence of hepatitis B virus of around 9.1% in the general population and 3.6% for hepatitis C virus (HCV) (2). The Northern region appears to be one of the least affected regions in Burkina Faso, with a seroprevalence of 6.6% for hepatitis B and 4% for hepatitis C [2].

The modes of contamination for these hepatitises are different, but exposure to blood remains a major mode of contamination. This means of transmission of viral hepatitis determines the target populations for which special surveillance is required. Volunteer blood donors are one of these target populations of general interest, this is why numerous serosurveillance studies target them [3]-[6].

The Ouahigouya's blood sampling and distribution depot (BSDD) opened in 2017. It supplies the city's regional teaching hospital with labile blood products. It helps to improve patients' care by referring patients tested positive to the clinical care departments of the regional university hospital.

In order to assess this new activity in our region, and to estimate the seroprevalence of viral hepatitis B and C together with HIV, we thought it would be appropriate to analyse the data from this BSDD. The general aim of this study was to assess HBV, HCV and HIV infections and co-infections among volunteer blood donors in the Northern region.

2. Patients and Methods

This is a cross-sectional study, with retrospective data collection. Our study population consisted of all volunteer blood donors who gave blood at the Ouahigouya BSDD over a two-year period from 1 January 2019 to 31 December 2020. This is an exhaustive, census of all blood donors collected by the Ouahigouya DPD/PS, whose data is compiled in the center's database.

Blood was collected after an initial interview during which the socio-demographic data of the donors and any contraindications to blood collection were recorded.

Persons authorized to donate blood must meet the following criteria:

- Age between 18 and 65;
- Must not have received a blood transfusion in the 6 months preceding the donation;
- Not be known to be HIV-, HBV-, HCV- or syphilis-positive;

- Not be of low weight for height;
- Do not engage in risky behavior or have a high-risk occupation;
- Not be pregnant, or in the immediate post-partum or menstrual period;
- Do not have a progressive medical pathology;
- Must respect a minimum 3-month blood donation interval.

Blood samples were taken from patients with no contraindications, and serological tests were carried out using ELISA tests. Hepatitis B surface antigen (HBsAg) and anti-HCV antibody (AcVHC) were detected using Hepanostika HBsAg Ultra (Biomérieux, Boxtel, The Netherlands) and Hepanostika HCV Ultra (Beijing United Biomedical Co. Ltd., Beijing, China), respectively. Antibodies to HIV types 1 and 2 were tested using Vironostika HIV Uni-Form II Ag/Ab (Biomérieux, Boxtel, The Netherlands). All samples reactive for HIV, HBsAg and HCV were retested for confirmation using a second enzyme-linked immunosorbent assay (Bio-Rad, Marnes la Coquette, France). A result was considered positive if both the first and second tests were positive.

Serological tests to detect occult infections, notably systematic viral load assays and viral genomic screening, are not available at the Ouahigouya BSDD.

3. Results

In two years, the BSDD recorded 9726 donations from 6217 new volunteer blood donors and 3509 old donors.

The average age of blood donors was 25.59 +/− 8 years, with extremes of 18 to 62 years.

The sex ratio was 3.43, with 77.5% of male donors and 22.5% of female donors. Table 1 summarizes the socio-demographic characteristics of donors.

The seroprevalence of hepatitis B in all blood donations was 7.31%, that of hepatitis C antibody 3.10% and that of HIV 2.12%.

HIV-HBV co-infection was found in 25 donors (0.25%), HIV-HCV co-infection in 9 donors (0.09%), HBV-HCV co-infection in 32 donors (0.32%) and HBV-HCV-HIV triple infection in 4 donors (0.04%). Table 2 summarizes seroprevalence by socio-demographic status

Table 1. Socio-demographic characteristics of the study population.

	Donors	Number (%)	Sexe (%)		**Total**
			M	F	
Year 2019	new	3066 (67)	2289 (50.3)	777 (17)	4547
	old	1481 (33)	1173 (26)	308 (6.7)	
Year 2020	new	3151	2406 (46.5)	745 (14.4)	5179
	old	2028	1666 (32.1)	362 (7)	
Total		9726	7534 (77.5)	2192 (22.5)	

Table 2. Seroprevalence by socio-demographic status.

Characteristic	VHB (%)	VHC (%)	VIH (%)	VHB-VHC (%)	VHB-VIH (%)	VHC-VIH (%)	VHB-VHC-VIH (%)
All	711 (7.31)	301 (3.1)	207 (2.12)	32 (0.33)	25 (0.25)	9 (0.09)	4 (0.04)
Men	595 (6.11)	261 (2.68)	152 (1.56)	30 (0.31)	23 (0.23)	6 (0.06)	3 (0.03)
Women	116 (1.2)	40 (0.41)	55 (0.56)	2 (0.02)	2 (0.02)	3 (0.03)	1 (0.01)
New donor	657 (6.75%)	253 (2.6)	187 (1.92)	30 (0.31)	24 (0.24)	9 (0.9)	4 (0.04)
Old donor	54 (0.55)	48 (0.49)	20 (0.20)	2 0.02)	1 (0.01)	0(0)	0 (0)

4. Discussion

This study of the seroprevalence of viral hepatitis in a specific population of volunteer blood donors has limitations inherent in the way the data were collected. Indeed, it was a retrospective data collection, based on data from the platform of our national blood transfusion center. This led to a loss of data on numerous socio-demographic aspects such as profession, origin, marital status, level of education and socio-economic status. In addition, physical examination data are not collected. Possible risk factors are not recorded, and the follow-up circuit for seropositive patients is not defined, resulting in patients being lost to follow-up. However, the seroprevalence results obtained allow us to make a few comments

The population of volunteer blood donors in the North region of Burkina Faso is young, with an average age of 26 years. The sex ratio is 3.43. This young age reflects the general population of Burkina Faso. According to the 5th general population and housing census, 43.5% of the population is under 15, giving an overall average age of 21.7 [7]. However, the young age and male prevalence reported in several studies suggest that volunteer blood donors are mainly young and male. Al-Waleedi in Yemen reported an exclusively male population with an average age of 29.3 years [3]. Boushad in Mauritania [4] had a sex ratio of 5.2 for an average age of 32.7, while Harry in Nigeria [5] also had an all-male population. This male predominance is also found in America; Lopez in Mexico had 89% males for an average age of 33.2 years [8], while in Brazil, the authors [9] reported a population of average age ranging from 25 - 44 years, 63% male. This predominance of men could be linked to social constraints in Africa and the lack of education among women.

The seroprevalence of hepatitis B and C in our study was 7.31% and 3.10% respectively. This is comparable to the general seroprevalence of hepatitis B and C in the Northern region of Burkina Faso. Indeed, Méda and colleagues in the 2015 Demographic Health Survey (DHS) found a respective seroprevalence of hepatitis B and C of 6.6% and 4% in the northern region. In this study, the national seroprevalence of hepatitis B and C was 9.1% and 3.6% respectively [2].

Work on blood donors would therefore be a good means of epidemiological surveillance of the development of viral hepatitis in Burkina Faso, given the congruence of the results with surveillance data for the general population. The

literature shows that the seroprevalence of hepatitis B and C can be observed in previous studies carried out in Burkina Faso in regional blood transfusion centers (RBTC). Nagalo and colleagues [10] [11] observed a steady decline in the seroprevalence of hepatitis B and C between 2009 and 2015. Between 2009 and 2012, the seroprevalence of hepatitis B among volunteer blood donors fell from 14.96% to 13.4%, and that of hepatitis C from 8.69% to 6.3% in Burkina Faso's regional Blood transfusion Center (RBTC).

With the introduction of universal vaccination against hepatitis B for all children in Burkina Faso in 1996, given the age of our study population, there is high probability that this generation be the last one in Burkina Faso not systematically vaccinated under the Expanded Programme on Immunisation. In future studies, we can therefore hope for a drastic reduction in the seroprevalence of these hepatitises, which is similar to the epidemiological changes observed by Lingani and colleagues [12]. This includes the seroprevalence of hepatitis B and C in children vaccinated in Nanoro, Burkina Faso.

Beyond Burkina Faso, studies of the seroprevalence of hepatitis B and C among volunteer blood donors are also an effective way of estimating the overall seroprevalence of these diseases in the general population. Numerous studies of blood donors around the world bear witness to this [4] [5] [9] [13]-[16].

The major challenge posed by blood donors lies in the grey areas represented by the residual risks of transmission that persist among blood donors despite increasingly stringent screening using sensitive tests. It appears in our results that 3% of former blood donors were tested positive for hepatitis B and 2.75% for hepatitis C. Koura and colleagues [17] reported a residual risk of hepatitis B transmission among blood donors in Burkina Faso. They reported one risk in 302 donations for hepatitis B with an incidence of 2.16/100 donors-years and one risk in 213 donations with an incidence of 2.59/100 donors-years.

This risk is multifactorial. It could be linked to periods of seroconversion. Blood donations could be made by people who are seroconverted but are not yet detectable by the usual screening methods [17]. Another hypothesis could be linked to occult hepatitis B and C. Takuissu and colleagues [18] conducted a meta-analysis to determine the seroprevalence of occult hepatitis B in blood donors. They reported a seroprevalence of 6.2% in HBsAg-negative and HBcAb-positive blood donors. Zhou and colleagues [19] found an average hepatitis C seroconversion rate of 0.53% among blood donors in China, with a significant variation from 1.58% before 1998 to 0.51% after 1998. In the context of our work, the screening of occult hepatitis B or C is not carried out systematically, so this possibility is not negligible. The third hypothesis concerning the residual risk that could be represented by voluntary blood donors would be a lack of effective awareness-raising, which would result in blood donors behaving in a risky manner, especially as this is a young population. This hypothesis is not yet supported by scientific research, but it remains a possibility.

In any case, it is important that national transfusion safety policies change, with

the introduction of additional tests such as viral load or viral genomic screening, in order to increase the safety of our transfusions and reduce the risk of transmission of occult hepatitis. It is also necessary to create a circuit for the care of blood donors screened for viral hepatitis, in order to reduce the number of donors lost to follow-up and to initiate early treatment.

We report co-infections between HIV, HBV and HCV in proportions of 0.25% HIV-HBV co-infection, 0.09% HIV-HCV co-infection, 0.32% HBV-HCV co-infection and 0.04% triple co-infection between HIV-HBV-HCV. These conditions have the same modes of transmission, which justifies their coexistence. However, a comparison with data in the literature reveals higher seroprevalence of co-infections among blood donors. Buseri and colleagues in 2009 [20] reported HIV-HBV co-infection of 33.3%, HBV-HCV co-infection of 11.1% and HIV-HCV co-infection of 11.1%. Tessema and colleagues, [21] reported an HIV-HBV co-infection rate of 34%. In Ethiopia, Abate [22] reported HIV-HBV co-infection of 56.2%. Karabaev [23] reported an HIV-HCV co-infection rate of 4.9%. Analysis of these seroprevalences in the literature suggests a low seroprevalence of these co-infections in our centre.

The seroprevalence of these co-infections does not appear to be proportional to the seroprevalence of each condition considered separately. In fact, Tessema [21], with a seroprevalence of viral hepatitis B and C and HIV of 4.7%, 0.7% and 3.8% respectively, found an HIV-HBV co-infection rate of 34%. Similarly, Abate and colleagues [22] with similar seroprevalences (HIV: 3.16%, HBV: 9.48%, HCV: 0.73%) reported an HIV-HBV co-infection rate of 56.2%. With lower seroprevalences, Karabaev and colleagues [23] (HBV: 3.6%, HCV: 3.1%, HIV: 0.78%) reported an HIV-HCV co-infection of 4.9%, also higher than our data. This could describe a disparity in modes of contamination between countries. While in Africa the most important mode of contamination for viral hepatitis B is vertical contamination [24] [25], the high HIV-HBV co-infections could be explained by the combination of other modes of contamination, particularly sexual. Similarly, in view of the higher seroprevalence of HIV-HCV co-infections, it might be possible to suggest an association between sexual and blood contamination.

5. Conclusion

The seroprevalence of viral hepatitis in the Northern region of Burkina Faso remains high among volunteer blood donors. This seroprevalence reflects fairly well the data for the general population. HIV-HBV and HIV-HCV co-infections are found in small proportions in our sample. A further study of volunteer blood donor populations in our country could show the effect of universal vaccination introduced in Burkina Faso in 2016, with the first vaccinated children reaching the legal age for donating blood in 2024.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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