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Seroprevalence of viral hepatitis B and C in two populations: blood donors and patients with suspected hepatic cirrhosis in Kwilu province, Democratic Republic of Congo

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ABSTRACT

Introduction: Hepatitis B virus (HBV) and hepatitis C virus (HCV) infections are associated with high morbidity and mortality in the developing world. The global mortality caused by viral hepatitis is higher than that caused by HIV infection. Screening of two different populations – blood donors and patients with suspected hepatic cirrhosis – can help to estimate the seroprevalence in the population and what the burden of the infection is on liver disease.

Methods: This was a cross-sectional, descriptive study performed in Vanga, a rural region of the Democratic Republic of Congo. Data were used from 2016 to 2018 for blood donors, and patients with ascites and abnormal liver ultrasound.

Results: A total of 3,497 blood donors were recruited, among whom 92.5% were male; 3% were positive for HCV antibodies; 3.4% were positive for HBsAg; and 0.4% for HBsAg and HCV, respectively. There were 190 patients with suspected cirrhosis on ultrasound: 71 (37.4%) were female and 119 (62.4%) male; 32.6% and 10.6% were positive for HBV and HCV, respectively; 2.6% were co-infected with HBV and HCV.

Conclusion: Blood donors and patients with ascites and liver abnormalities were frequently infected by HBV, HCV, and/or HIV in a rural region of the DRC. Detection is essential for limiting the risk of transmission and treating those infected.

Introduction

Hepatitis B virus (HBV) and hepatitis C virus (HCV) infections in the developing world are associated with high morbidity and mortality due to the risk of developing cirrhosis, liver failure, hepatocellular carcinoma, and death (McMahon, 2009). According to the Global Hepatitis Report by the World Health Organization (WHO) in 2015, an estimated 257 million people worldwide were infected with HBV and 71 million people with HCV, causing about 1.34 million deaths annually (The Lancet GBD 2017, 2018); this is comparable with the number of deaths caused by tuberculosis, malaria, and HIV (The Lancet GBD 2017, 2018). However, while the number of deaths due to tuberculosis, malaria, and HIV were declining between 2000 and 2015, mortality due to viral hepatitis was increasing (The Lancet GBD 2017, 2018).

Most HBV infections in Sub-Saharan Africa occur before the age of 5 years. Two important modes of transmission are coexisting: mother-to-child-transmission and horizontal transmission between children before the age of 5 years. Perinatal infection carries an approximate 90% risk of chronicity, whereas this risk declines from about 60% to approximately 20-30% between 6 months and 5 years of age. Approximately 5% of people infected after the age of 20 years develop chronic infection (McMahon, 2009).

Unsafe blood product administration represents an important risk of transmission of HCV in Sub-Saharan Africa. However, there are also several other risk factors such as unsafe medical practice (Sonderup et al, 2017). During the acute phase 18-34% of patients spontaneously clear HCV, whereas 10-20% develop cirrhosis in cases of chronic HCV infection within 20 years. In these cirrhotic

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HCV patients, the annual risk of developing hepatocellular carcinoma (HCC) lies between 1-5% (Westbrook et al, 2014).

Most of the seroprevalence data available for hepatitis B and C are derived from blood donors. In Sub-Saharan Africa, HBV seroprevalence in blood donors is high: for example, it was 7.5% in Ghana in 2014 (Osei et al, 2017), 9.7% in Sierra Leone (Tognon et al, 2020), and 7.3% in Gabon between 2009 and 2016 (Eko Mba et al, 2018). Regarding HCV infection, data for Africa are scarce but a recent meta-analysis estimated HCV seroprevalence to be around 3% (Rao et al, 2015).

In the Democratic Republic of Congo (DRC), in a systematic review of 28 published studies between 2000 and 2016, HBsAg seroprevalence was estimated at 5% in blood donors and pregnant women (Shindano et al, 2018). Regarding HCV infection, a meta-analysis published in 2016 found an overall pooled prevalence of anti-HCV antibodies of 2.9% (Muzembo et al, 2016). A study carried out in 2012, looking at people aged >70 years in Kinshasa, found a seroprevalence for HCV of 25.9% (Hogan et al, 2016). Another survey assessing HCV viremia found a prevalence of 0.9% in adults aged >40 years (Parr et al, 2018). Blood donors are often people in the community with apparent good health, who are unaware of their HCV and HBV status, and who find an opportunity to know it when they become blood donors. Patients with ascites and suspected cirrhosis who visit the hospital are known to be at high risk of having positive serology of HCV and/or HBV. Most studies that have determined the seroprevalence of HBV and HCV in the DRC have been performed in urban areas (Shindano et al, 2018; Muzembo et al, 2016) and they only concern the population of blood donors. Few data are available for the rural zones and western part of the country. No study has simultaneously looked at the two opposite spectrums of viral liver disease seroprevalence. This should help to determine the trend of the burden of HBV and HCV in the blood donor population and what can be observed in the population of patients with ascites and suspected cirrhosis.

This study aimed to describe seroprevalence in the blood donor population, which is made up of apparently healthy people in the community, and seroprevalence in the population of patients with ascites and suspected cirrhosis attending the hospital, to observe whether the trends of seroprevalence are the same for HCV or HBV burden in these two populations in the rural area of Vanga.

Patients and Methods

Methods

Study design

This was a cross-sectional, descriptive study. Data were used from 2016 to 2018 for blood donors, and patients with ascites and abnormal liver on ultrasound.

Setting

Data were collected at the Vanga Evangelical Hospital (HEV), which is the general reference hospital of Vanga health zone located in Kwilu province, 530 km east of Kinshasa, 35 km from Bulungu Hospital, and 60 km from Djuma Hospital. The hospital has a total of 479 beds and serves a health zone with a population of >300,000 people as well as patients from neighboring health zones. The population around HEV is poor, with his main income activity being agriculture and small businesses. Malaria, malnutrition, and tuberculosis are known as major health problems in the region. The Vanga Hospital blood bank is managed by the laboratory department of the hospital. Blood donors are voluntary or family members. Paid donors are rare, due to the cost and lack of money in a poor setting. In this study, 70 donors were paid; all the others were family donors (n = 2,931) or volunteers (n = 492). For voluntary donors, the hospital organizes blood donation in the Vanga health zone villages. Family members are those accompanying the sick person from their family. Blood products are available for all patients who need a transfusion in the hospital.

Participants

The population was made up of all blood donors recruited during the period 2016 to 2018, and anyone who had ascites and abnormal liver structure visible on ultrasound during the same period. Blood donor records were used to collect information on blood donors. Patient records of ascites were used, where cirrhosis or HCC was suspected and HBV and HCV tests were performed. To be a blood donor and be admitted for a blood test, a person should present the following criteria: aged 18-65 years, normal blood pressure, and weight >50 kg. Suspected cirrhotic patients were those with ascites and abnormal structure on liver ultrasound.

Laboratory analysis

Detection of HBsAg was performed using a rapid screening test from ENCODE brand manufactured by Zhuhai Encode Medical Engineering, China, following manufacturer's instructions. HCV antibodies were detected in the serum from ENCODE brand manufactured by Zhuhai Encode Medical Engineering, China, as instructed by the manufacturer. The abdominal ultrasound was performed by a trained hospital physician. The liver ultrasound protocol described the structure of the liver (regularity of the surface with a nodular aspect or not, echogenicity of the liver, and the presence of ascites or not).

Data analysis

Collected data were recorded in Excel 2020 software and then transferred to SPSS version 20 for analysis. The recording system contained the name, gender, and age of the blood donors and suspected cirrhotic patients. All data were checked to exclude the possibility of a duplicate blood donor. Descriptive analysis was used to show the proportion of each variable. The age groups were different depending on whether they concerned blood donors or patients with ascites and suspected hepatic cirrhosis: the minimum age to be a blood donor is 18 years, whereas there have been patients with ascites and suspected hepatic cirrhosis aged <18 years.

Ethical consideration

All blood donors and suspected cirrhotic patients gave oral consent before blood collection and the study was approved by the Comité National d'éthique de la Santé on the following number № 100/CNES/BN/PMMF/2019.

Results

A total of 3,493 blood donors were recruited, among whom 3,232 (92.5%) were male; 106 (3%) were positive for HCV antibodies, and 117 (3.4%) positive for HBsAg; 13 (0.4%) were co-infected with HBsAg and HCV. The seroprevalence of HBV was higher in those aged between 40-49 years and decreased after the age of 50 years (Table 1). The same trend was observed for HCV, with high seroprevalence among those aged 40-49 years and less after 50 years (Table 1).

There were 190 patients with ascites and abnormal liver structure on ultrasound: 71 (37.4%) were female and 119 (62.6%) male. A total of 82 patients (43.7%) with ascites and suspected hepatic cirrhosis were infected with either HBV, HCV or both: 62 (32.6%) and 20 (10.6%) were positive for HBV and HVC, respectively. Five (2.6%) were co-infected with HBV and HCV (Table 2). The majority of those who were positive for HBV among patients with ascites and abnormal liver structure on ultrasound were in the 20-59 years age group (45.3%) (Table 3).

Table 1
Number and prevalence (percentage) of each infection and combination among blood donors.

Age group	Prevalence	Sex Male	Female	Both sexes
18–29 years	HBsAg	32 (3.3%)	3 (6.6%)	35 (3.4%)
	HCV	28 (2.9%)	2 (4.4%)	30 (2.9%)
	HBsAg &HCV	1 (0.1%)	1 (2.2%)	2 (0.2%)
30–39 years	HBsAg	35 (3.2%)	5 (7.4%)	40 (3.5%)
	HCV	27 (2.5%)	0	27 (2.3%)
	HBsAg & HCV	2 (0.2%)	0	2 (0.2%)
40–49 years	HBsAg	33 (3.8%)	3 (3.6%)	36 (3.8%)
	HCV	37 (4.2%)	2 (2.4%)	39 (4.1%)
	HBsAg & HCV	8 (0.9%)	0	8 (0.2%)
>49 years	HBsAg	6 (1.9%)	0	6 (1.6%)
	HCV	10 (3.2%)	0	10 (2.7%)

Table 2
Sex differences in patients with ascites and abnormal liver structure on sonography.

	Women	Men	Total
HBsAg -	58 (81.7%)	70 5(8.8%)	128 (67.4%)
HBsAg +	13 (18.3%)	49 (41.2%)	62 (32.6%)
Total	71	119	190
HCV -	62 (87.3%)	108 (89.5%)	170 (89.5%)
HCV +	9 (12.7%)	20 (10.5%)	29 (10.5%)
Total	71 (37.4%)	119 (62.6%)	190

HBsAg is statistically significantly more common in men than in women (p-value is 0.001)
For HCV, there is no significant difference.

Table 3
Differences between age groups in patients with ascites and abnormal liver structure on sonography.

	3-19 years	20-59 years	>60 years	Total
HBsAg -	53 (86.9%)	58 (54.7%)	17 (73.9%)	128 (67.4%)
HBsAg +	8 (13.1%)	48 (45.3%)	6 (26.1%)	62 (32.6%)
Total	61	106	23	190
HCV -	60 (98.4%)	94 (88.7%)	16 (69.6%)	170 (89.5%)
HCV +	1 (1.64%)	12 (11.3%)	7 (30.4%)	20 (10.5%)
Total	61	106	23	190

HBsAg is statistically significantly more common in the middle age group than in the two others ($p<0.001$)

Discussion

The HCV seroprevalence in this study was about 3.0% among blood donors and 3.4% for HBV. It must be mentioned that 92.5% of blood donors were male, since the majority of women were excluded by criteria linked to being a blood donor, mainly: nutritional status and menstruation leading to an anemic status.

Rao et al, 2015 described seroprevalence of HCV around 3% in Africa, which was the same trend observed in the current study, while a meta-analysis published in 2016 found an overall pooled prevalence of anti-HCV antibodies of 2.9% (Muzembo et al, 2016) in the DRC. Another study carried out in 2012, looking at people aged >70 years in Kinshasa, found a seroprevalence for HCV of 25.9% (Hogan et al, 2016). Parr et al, 2018 found a prevalence of 0.9% in adults aged >40 years; the difference could be due to the population and setting of the study. The current results showed ongoing infection in the population, due to unsafe medical practice in the remote regions like administration of blood products, reuse of contaminated material, and unsafe therapeutic injections.

According to HBV, the seroprevalence in the current study was less than in other African countries: it was 7.5% in Ghana in 2014 (Osei et al, 2017), 9.7% in Sierra Leone (Tognon et al, 2020), and 7.3% in Gabon between 2009 and 2016 (Eko Mba et al, 2018). However, the current results were relatively close to the weighted national prevalence of 3.3% (Peyton Thompson 2019) but less than that observed by Tony Shindano et al, 2018 (5.0%) in blood donors.

In contrast, a seroprevalence of 10.6% for HCV and 32% for HBV was found among patients with liver abnormalities and ascites. The current results are very different from those found in the city of Kinshasa where, in cirrhosis, the frequency of HBsAg and anti-HBc antibodies was 33.3% and 83.3%, respectively (Fréquence des hépatites virales, 2020). The predominance of seroprevalence of HBV and HCV among patients with cirrhosis was similar to the current results in Ghana (Aboagye, 2020), with a proportion of 42.86% positive with HBsAg and 5.7% positive with HCV. In Nigeria, HBV and HCV seroprevalence was within the range of 2-20% and 0.5-15%, respectively, among patients with chronic liver diseases in a systematic review that included 69 scientific reports and 16 grey literature (Maisanda et al, 2018).

The difference in seroprevalence in the group of blood donors and patients could be due to the natural history of each infection. The high seroprevalence of HBV in patients with ascites and liver abnormalities could be explained by the fact that in developing countries like the DRC, the vast majority of HBV infections occur through mother-to-child transmission and horizontal transmission between children before the age of five years (Wu et al, 2015). Knowing that 80–90% of infants are infected during the first year of life and 30-50% of children are infected before the age of 6 years develop chronic infections (Hepatitis B, 2020), those who contracted the infection before the age of 6 years have up to a 90% chance of developing liver chronic disease, while 5% of people infected after the age of 20 years develop chronic infection (Hepatitis B, 2020). This situation could be prevented by vaccination. However, it must be outlined that the vaccination against HBV in DRC was officially implemented in 2007, suggesting that the 20-59 years population most affected in the current study was not vaccinated due to the absence of vaccine at that time.

The seroprevalence of HCV infections was less than HBV seroprevalence, which can be explained by contamination through unsafe injections and blood products, which are considered to be the main route of transmission in sub-Saharan Africa in adults. Approximately 10-20% of individuals with chronic HCV infection in association with other factors (alcohol intake, gender, age) can develop cirrhosis (Chen et al, 2006).

Limitations

Although this study is the first to describe the HCV and HBV seroprevalence situation in the western part of the DRC by simultaneously describing the situation in blood donors, who are supposed to be healthy people, and the sickest population, limitations remain important. This study was limited to knowledge of gender and age, while other data such as the level of education, marital status, risky behaviors such as alcohol consumption, were not collected. This did not enable further analyses of risk factors and this requires further study. Moreover, this study showed that the majority of suspected cirrhotic patients in Vanga were not infected by HBV, HCV or HIV, which also deserves a prospective study to identify all risk factors associated with cirrhosis such as alcohol. One potential explanation for the cirrhotic group is the absence of liver biopsy and biological markers associated with cirrhosis such as a low level of platelets, low level of serum albumin, and/or impaired hemostasis. It is impossible to ascertain whether ascites was linked to cirrhosis and not another disease such as heart failure or tuberculosis. This study looked at seroprevalence, so no HVC or HBV viremia was determined.

In conclusion, this study showed that blood donors and patients with ascites and liver abnormalities were frequently infected by HBV, HCV, and/or HIV, even in a rural region of the DRC. However, the burden of each infection could be different depending on

the group of blood donors or suspected cirrhotic patients. To try to limit the risk of transmission and for those infected, it is important to detect them in order to treat them.

There is no conflict of interest, nor funding and the study received the approval number № 100/CNES/BN/PMMF/2019 of the National Comité d'éthique de la Santé (RDC).

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