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Incidence of hepatitis B and C in voluntary blood donors in a private clinic in Angola from 2011 to 2016

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ABSTRACT

Objective: Screening blood donors for sexually transmitted diseases is becoming increasingly important. Donors are referred to screening centres, thus ensuring the quality of blood transfusions and avoiding transmission of the hepatitis B and C viruses. This study aimed to identify the incidence of positive serological markers for hepatitis B and C among blood donors. A retrospective descriptive prevalence study was carried out using the data base of serological positive markers for hepatitis B and C, the surface antigen of the hepatitis B virus (HBsAg), the positive hepatitis B core antibody (HBcAc), the antibody to the hepatitis C virus (anti-HCV). A total of 2734 donors were followed from 2011 to 2016 at Clínica Girassol, Angola. Analysis was carried out using the statistical data analysis program SPSS® v.22.0.

Results: Donors were aged between 18 and 64 years (median age of 32 ±9); 1373 (50.2%) donors tested positive for HBsAg, 731 (62.9%) for HBcAc and 140 (5.1%), were positive for anti-HCV. The majority, tested were men with 2467 (90%) and 267 (10%) were women. In conclusion, the study demonstrated the importance of screening to ensure donor blood safety and avoid transmission of infections by blood transfusion.

KEYWORDS: Donor Blood, Prevalence, Epidemiology.

CITATION OF THE ARTICLE

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I. INTRODUCTION

Screening blood donors for sexually transmitted diseases is becoming more and more important [1]. Hepatitis B and hepatitis C are diseases transmitted both through sexual contact and through blood. The risk is believed to be high in countries in sub-Saharan Africa [2], which is why the World Health Organization (WHO) has implemented norms for safe blood transfusion [3]. Accordingly, Angola complies with the rules for obligatory screening of blood donors [4].

Blood donors are referred to centres where this compulsory screening is carried out. The Immunohaemotherapy Service of the Clínica Girassol has been receiving an increasing number of donors for compulsory screening, in order for them to be able to donate blood. Initial assessment of these donors includes tests to identify markers for hepatitis B and hepatitis C, and if these are found to be positive, the patients are referred to a specialist. Other factors assessed in the potential donor are alcohol and medication consumption and other sexually transmitted diseases, namely Human Immunodeficiency Virus (HIV) and syphilis. Assessment of the donor's comorbidities is crucial in defining the risks that blood donation may present.

II. MATERIAL AND METHODS

This study is a retrospective descriptive prevalence study, analysing blood donations from donor records for the years 2011 to 2016 at Clínica Girassol, Luanda, Angola. Was approved by the Research Ethics Committee of the Institute of Public Health of the Republic of Angola number 25-2017 and 04-2018, all blood donors gave written individual consent and the Ethics Committee also allowed disclosure of the data.

All donated blood is tracked. The methods were carried out in accordance with the guidelines, regulation and consent for the study.

There are several units with equipment for blood collection, screening and transfusion, including the Clínica Girassol, which also complies with the rules. However, the drawback is that in this type of blood donation many diseases are detected.

The Immunohaemotherapy Service follows the guidelines for compulsory screening of blood donors. The Enzyme-Linked Immunosorbent Assay (ELISA) test was used to screen for hepatitis B virus surface antigens (HBsAg), hepatitis B virus core antibodies (HBcAc) and hepatitis C virus antibodies (anti-HCV).

In order to assess the results, a retrospective study of the donor database was undertaken. Between 2011 and 2016, 2734 adult blood donors were observed between the ages of 18 and 64; the demographic data of the donors was recorded and HBsAg, HBcAc and anti-HCV status. These tests are mandatory for all blood donors: they were not performed for the purpose of the study. Our aim was to discover, in this sample of blood donors, those who had positive results from diseases transmissible by blood transfusion. Donor screening is in place in Angola. There are health facilities that have equipment for blood collection and transfusion as well as screening. Blood and plasma of voluntary donors and their families was collected in the province of Luanda, according to the regulations and norms for blood collection. Using appropriate collection tubes, five millilitres (5ml) of blood was taken from each donor, which was kept at the recommended temperature.

Screening for HBsAg and HBcAc

Screening for HBsAg was undertaken using kits for the ELISA ARCHITECT test, as well as Abbott *i*1000Sr (ARCHITECT HBsAg and HBcAc qualitative screening kit). The test procedure and the interpretation of the results were undertaken according to the instructions in the manufacture's manual. Samples with dubious results (grey area) were repeated using the same kit and a different methodology, and results were confirmed using the Roche Cobas 601. Samples which were repeatedly positive were considered to be anti-HBc positive.

Screening for HCV

Screening for the HCV antibody was performed using the techniques described above, using the kits for the ELISA ARCHITECT plus *i*1000Sr Abbott (Architect anti-HCV assay Kit). The test procedure and the interpretation of the results were undertaken according to the instructions in the manufacture's manual. Samples with dubious results (grey area) were repeated using the same kit and a different methodology, and results were confirmed using ADVIACentar XP Immunoassay system.

The laboratory of the Immunohaemotherapy Service is certified by IQNet Certified Management Systems.

Statistical analysis

Categorical variables are described as absolute and relative frequencies, continuous variables are described through median and standard deviations or from the median and percentiles, according to the symmetry of their distribution. The prevalence of infections was estimated and also categorized for each variable of interest, then presented as relative frequency (%) with respective confidence intervals at 95%. The power of the study is 80%. In order to test hypotheses on the independence of categorical variables, the Chi-square test of independence or Fisher's exact test was applied, as appropriate.

In all the hypothesis testing a level of α = 5% was considered significant. The analysis was undertaken using the statistical analysis program Statistical Package for the Social Sciences v22.0 (SPSS® v22.0).

Availability of data and materials

The data sets used and/ or analyzed during the current study is available from the corresponding author on reasonable request.

III. RESULTS

A total of 2734 donors were screened, who were mostly men (90%) and of Angolan nationality (98%). The age of the donors ranged between 18 and 64 years (average = 32 ± 9); <25 years, 590 donors (21.6%); 25-29 years, 678 donors (24.8%); 30-34 years, 539 donors (19.7%); 35-39 years, 386 donors (14.1%) and ≥40 years 541 donors (19.8%). The majority, of those who were tested 2467 (90%), were men and 267 (10%) were women. As regards the year of blood collection, an increase in donations was seen in the year 2016 (2%). A rate of 50.2% positive results were seen for HBsAg, 62.9% for HBcAc and 5.1% for markers for hepatitis C infection. See **Table 1.**

Table 1. Total distribution of donors observed (n = 2734)

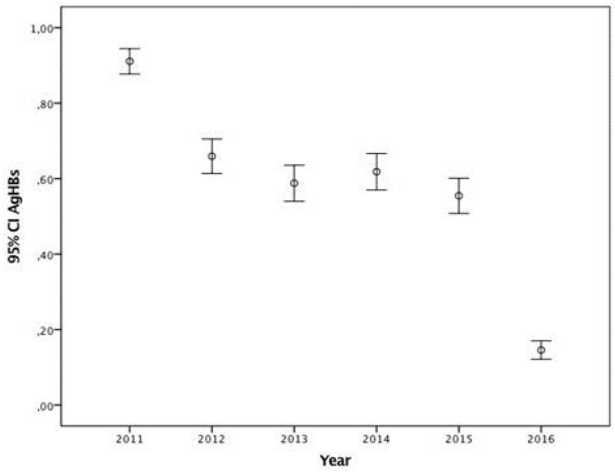
	n	(%)
Sex		
Male	2467	90%
Female	267	10%
Age, average (sd)	32 (9)	
<25	590	21.6%
25-29	678	24.8%
30-34	539	19.7%
35-39	386	14.1%
≥40	541	19.8%
Year of Collection		
2011	281	10.3%
2012	414	15.1%
2013	410	15.0%
2014	393	14.4%
2015	440	16.1%
2016	796	29.1%
Nationality		
Angolan	2671	97.7%
Non-Angolan	63	2.3%
HBsAg		
Positive	1373	50.2%
Negative	1361	49.8%
HBcAc*		
Positive	731	62.9%
Negative	432	37.1%
No information	1571*	-------
Anti-HCV		
Positive	140	5.1%
Negative	2588	94.9%
Dubious	3	-------
Not Tested	2	------
Indeterminate	1	------

**There is no information for these donors' HBcAc*

HBsAg

Statistically significant differences for gender, age and year of collection can be observed among donors with regard to positive results for HBsAg. There is a higher prevalence among male donors than female donors and this difference is statistically significant (51% [49-53] vs 40% [34-46], p < 0.01). As regards age, a decrease in positive results is observed as age increases, varying between 68% in donors under 25 years of age and 36% for donors over the age of 35 to 40, p < 0.001, see **Table 2**. A decrease in positive results is also observed regarding year of collection from 91% in 2011 to 15% in 2016 (p < 0.001), see **Figure 1**.

Figure 1. Frequency of HBsAg marker 2011-2016 (p < 0.001).



HBcAc

Statistically significant differences are observed for positive results for HBcAc for both age and year of collection. With regards to age, older donors present a lower prevalence (56% [50%-62%]), with donors between the ages of 25 and 29 presenting the highest prevalence (72% [66%-77%]). For year of collection, positive results also vary between 67% for 2014 and 83% for the year 2016, p < 0.001. Regular testing for the core antibody (HBcAc) began at the Clínica Girassol in 2016, which is why data are scarce for years 2011 to 2014.

Anti-HCV

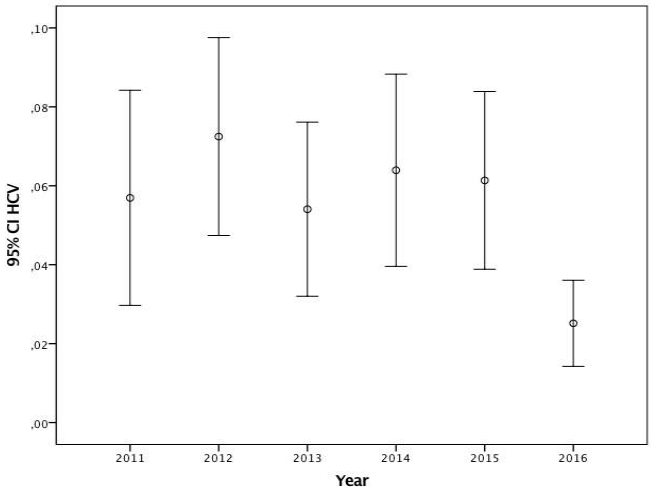
Statistically significant differences for gender, age of donor and year of collection can be observed in donors with regard to positive result for HCV. There is a higher prevalence among male donors than female donors (5% vs 2%, p < 0.001). With regard to age of donor, prevalence increases with age <25 years prevalence is 3% whereas it is 9% for donors over 40 years of age (p < 0.001), see **Table 2**. With regard to year of collection, a decrease is observed between 2011 and 2016 (6% vs 3%, p = 0.004), see **Figure 2**.

These results are alarmingly high since hepatitis B virus vaccination was available in these years, implying that we must intensify the vaccination campaign at the population level.

Table 2. Prevalence of TTIs (Transfusion-transmitted infections) in blood donors according to gender, age, year of collection and nationality.

	HBsAg positive			HBcAc positive			Anti-HCV positive		
	n total	n (%) [IC 95%]	p-value	n total	n (%) [IC 95%]	p-value	n total	n (%) [IC 95%]	p-value
Sex			**<0.001**			**0.663**			**0.011**
Male	2467	1266 (51) [49-53]		1045	659 (63) [60-66]		2461	135 (5) [5-6]	
Female	267	107 (40) [34-46]		118	72 (61) [52-70]		267	5 (2) [1-4]	
Age			**<0.001**			**0.004**			**<0.001**
<25	590	403 (68) [65-72]		236	141 (60) [53-66]		590	19 (3) [2-5]	
25-29	678	360 (53) [49-57]		280	201 (72) [66-77]		678	36 (5) [4-7]	
30-34	539	274 (51) [47-55]		244	152 (62) [56-68]		538	19 (4) [2-5]	
35-39	386	139 (36) [31-41]		178	111 (62) [55-69]		383	16 (4) [3-7]	
≥40	541	197 (36) [32-41]		225	126 (56) [50-62]		539	50 (9) [7-12]	
Year			**<0.001**			**<0.001**			**0.004**
2011	281	256 (91) [88-94]		0	0 (0) [-]		281	16 (6) [3-9]	
2012	414	273 (66) [61-71]		0	0 (0) [-]		414	30 (7) [5-10]	
2013	410	241 (59) [54-64]		0	0 (0) [-]		407	22 (5) [3-8]	
2014	393	243 (62) [57-67]		12	8 (67) [39-98]		391	25 (6) [4-9]	
2015	440	244 (56) [51-60]		357	71 (20) [16-24]		440	27 (6) [4-8]	
2016	796	116 (15) [12-17]		789	651 (83) [80-85]		795	20 (3) [2-4]	
Nationality			**0.501**			**0.056**			**0.255**
Angolan	2671	1344(50) [48-52]		1142	722(63) [60-66]		2665	135(5) [4-6]	
Other	63	29 (46) [34-58]		21	9 (39) [14-64]		63	5 (8) [3-16]	

Figure 2. Prevalence of anti-HCV 2011-2016 (p = 0.004).



IV. DISCUSSION

Screening for infectious disease (for the hepatitis B virus as well as hepatitis C) makes early diagnosis possible and subsequent referral of patients to specialized centres. Early diagnosis is crucial as it allows rapid therapeutic intervention, avoiding progression of the disease to cirrhosis of the liver and hepatocellular carcinoma [5].

This study reveals the seroprevalence of markers for the hepatitis B virus and hepatitis C in blood donors. A previous study of markers for the hepatitis B virus and hepatitis C undertaken in Luanda, revealed a prevalence of 40/431(9.3%) for HBsAg, while 35/431(8.1%) presented positive for anti-HCV [6]. Another study carried out at the Luanda public hospital revealed a prevalence of HBsAg of 77/508 (15.1%) and HBcAc 405/508 (79.7%), respectively [7].

In Africa, and particularly in Ethiopia, the prevalence of hepatitis B increases with age. In urban areas 75% of adults are infected and this is also true of many in rural areas [8]. A recent study carried out in the Democratic Republic of Congo showed a seroprevalence of 24.6% for hepatitis B and 2.3 % for hepatitis C [9]. On the other hand, a study carried out in the nearby countries of South Africa and Botswana showed that 72/950 (7%) of individuals were HBsAg positive [10].

In this study, the database for blood donors was used and a retrospective assessment was undertaken, for which 2734 donors were eligible. The results show that seroprevalence among apparently healthy blood donors was 1373/2734 (50%) for HBsAg, 731/1163 (63%) for HBcAc and 140/2734 (5%) for anti-HCV. Compared to other studies carried out in Angola and described above, an increase in seroprevalence for HBsAg is revealed with a decrease in anti-HCV. This significant increase in HBsAg findings could be explained by the increase in the number of apparently healthy volunteer donors who go to the clinic for obligatory screening. The study found that 69/314 (22%) tested positive for both HBsAg and HBcAc: this means that the donors were not aware that they were carriers of the hepatitis B virus and that when they completed the questionnaire at the blood bank they were considered asymptomatic blood donors, according to the WHO criteria.

The isolated presence of HBcAc found in 662/731 (91%) of donors, or reactivation of AcHBc does not necessarily indicate a high probability of transmission of infection, particularly in the absence of other markers for the hepatitis B virus. Screening for anti-HBc is considered an additional precaution for blood transfusion [11]. This position has led blood banks to adopt published algorithms for the implementation of screening for the anti-HBc marker [12], and would allow these blood banks to requalify anti-HBc positive donors for blood donation, thus reducing the loss of donors and at the same time, guaranteeing the safety of blood and other haemoderivatives [13],[14]. This is also why the Clínica Girassol, went on to administer the test routinely in 2016.

In the case of the hepatitis C virus, a rate of seroprevalence of 140 (5%) was found for blood donors who tested positive for the HCV antibody. As previously mentioned, the rate of seroprevalence in Angola among donors with positive anti-HCV was 8%. In this study, in a total of 2734 blood donors with positive markers for the infection, 140 presented a rate of seroprevalence of 5%. Seroprevalence of anti-HCV among donors was 135 (96%) in men and 5 (4%) in women.

This study shows that blood donors have high rates of seroprevalence both of HBsAg and HBcAc, but low rates of anti-HCV. This high seroprevalence is important because these donors were not aware that they were carriers of hepatitis B or hepatitis C and were considered asymptomatic. This study therefore reinforces the growing importance of obligatory screening of all blood donors.

In conclusion, these results show that we really are still a long way from halting the spread of hepatitis B; although vaccination is available we still have a high rate of infection and we need to intensify prophylactic measures.

V. LIMITATIONS

The study is mainly focused on donations for five years at Clínica Girassol. It would be crucial for the study to cover other institutions by analysing the characteristics of the donor for several years with a much larger population and for a longer period. The analysis of this study should be performed in several contexts for easy comparison with other studies. Further studies are likely to be conducted with the assistance of the Angolan Ministry of Health and may use the results of this study to assess the health and safety of blood donors in order to improve blood safety.

VI. AUTHOR'S CONTRIBUTIONS

Angelina Edna Quintas, were involved in the conception, design and written the study, **Adis Del Carmen Cogle**, was involved in interpretation of data. **Lemuel Cordeiro, Claúdia Camila Dias**, **Altamiro da Costa Pereira and António Sarmento** were involved in the conception and design of the study, interpretation of data, and drafting and revising the manuscript. All authors read and approved the final manuscript.

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Competing interests

The authors declare that there is no conflict of interest.

Consent for publication

This study had the consent of the Research Ethics Committee of the Institute of Public Health of the Republic of Angola.

Ethical considerations

All blood donors gave written individual consent and the Ethics Committee also allowed disclosure of the data. With regard to confidentiality, no names were involved in processing the data as only codes were used to identify donors. This study had the consent of the Research Ethics Committee of the Institute of Public Health of the Republic of Angola number 25-2017 and 04-2018.

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