

Seroprevalence of markers of transfusion-transmissible diseases in positive blood donors detected in routine screening in the Blood Bank of Hospital Carlos Luis Valverde Vega, Costa Rica. Period 2015 – 2019

Abstract

Blood is one of the fundamental tissues of our body. Blood donation allows blood banks to meet hospital needs for blood components. Blood transfusion is an activity that carries a risk, originated by a series of causal actions derived from the individual characteristics of donors and patients. Blood components are biological products and as such, they can never be exempt from the risk of transmitting infectious diseases, such as hepatitis B, HIV, syphilis, among others. Thanks to the investigation of the donor database of the Blood Bank of Hospital Dr. Carlos Luis Valverde Vega and the annual statistics of the blood bank, the statistics referring to donations were obtained, according to the type, grade of acceptance and as well as the prevalence of mandatory screening infectious diseases in the blood bank, between the years 2015 and 2019, with the respective authorization of the corresponding scientific ethics committee. This study reported a prevalence for Anti HB Core of 0.99%, 0.14% for HBsAg, 0.11% for syphilis, 0.05% for hepatitis C, 0.02% for HIV and 0% for the disease de Chagas and HTLV I / II. By using the bases of this work, future analyzes with a similar premise may be developed in different blood banks of the different health centers in our country.

Keywords: blood bank, blood donors, prevalence, transfusion-transmissible diseases

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Introduction

Blood is one of the fundamental tissues of our body: It is irreplaceable, it has vital functions in cellular respiration thanks to the hemoglobin and its participation in the liberation of oxygen in the tissues, in addition to maintaining the body's blood volume. Due to these characteristics, one of the main objectives of the pharmaceutical industry has been the development of solutions that fulfill these functions, however, it has not been possible to synthesize a molecule with characteristics similar to blood tissue which means that the only way to have this vital liquid in health centers is through blood donation.¹

There are 3 types of blood donations: voluntary or altruistic, family or replacement, and paid. Currently, in 57 countries around the world 100% of donations are obtained either altruistically or in replacement,² among which is Costa Rica.

Altruistic voluntary donation allows laboratories and blood banks to meet health centers needs for blood components. The donor gives his blood, however it is essential to evaluate different elements and parameters that enable to preserve both the donor safety at the time of donation and patient safety at the time of the transfusion of the corresponding blood component. The selection process together with the standardized screening tests are key points for transfusion safety.¹

Blood transfusion carries a risk, originated by a series of causal actions derived from the individual characteristics of the donors and patients undergoing this type of therapy. It should not be overlooked

that blood components are biological products and as such can never be exempt from the risk of transmitting infectious diseases, even though this risk can be significantly reduced by applying quality controls in the different phases of the blood donation process.¹

The serological screening of potentially blood-borne agents constitutes a fundamental step in the selection of blood component donors, recognized as such in 1975 by the World Health Assembly.² In the 1980s and early 1990s, the transfusion of infected blood was considered the cause of up to 10% of cases of human immunodeficiency virus (HIV).³ Costa Rica was one of the first countries in Latin America to enact laws, norms and regulations related to blood since 1960, which were issued to prevent the transmission of diseases such as Syphilis and Chagas disease; later Hepatitis and HIV.³

The processing of blood donations requires the screening of infectious markers: Hepatitis B virus surface antigen (HBsAg) and Anti-Hepatitis B Virus Core antigen (anti-HBc), antibodies against HIV type I or II (anti -HIV 1 and anti-HIV 2), antibodies against hepatitis C virus (anti-HCV) and syphilis serology.⁴ In the case of Costa Rica, given as it is an endemic area, the analysis of antibodies against Human Lymphotropic Viruses (anti-HTLV I-II) and markers for Chagas disease is also carried out.

The selection of donors is essential to improve transfusion safety, since depending on the sensitivity of the serological technique used, it will be the time of the serological detection window period, so in order not to expose the patient to potentially infectious blood components, it is necessary to make a strict selection of the donor

through the requirements that are assessed by an in-depth and direct interview with the donor by a health professional. However, despite the measures to prevent the transmission of infections through of blood donations in a blood bank, these persist for various reasons such as the different immunological periods for the screened infection markers, the existence of asymptomatic chronic carrier donors with negative serological results, infection with mutant strains that are not detectable by the tests applied in laboratories and finally, technical errors by the staff laboratory that should not happen.⁵

Materials and methods

To carry out this research, the donor database of the Blood Bank of Hospital Dr. Carlos Luis Valverde Vega and the consolidated annual statistics reported from the blood bank were investigated. As the investigation involved the use of personal data of donors, authorization was requested from the Hospital Bioethics Committee and later approved without presenting any observations.

Once authorization was obtained, a detailed analysis was performed: the total number of donations in each of the five years investigated, as well as the total temporarily and permanently deferred donors and the number of these who reported some seropositive

laboratory analysis; the absolute and relative frequencies of these variables through the 5 years of study.

Subsequently, these deferred donors were investigated in more detail to obtain the prevalence of each disease, according to with the number of positive donors among the total donations, through the 5 years of study. Additionally, it was necessary to check on the data system of the laboratory, Labcore, to review the values of donors whose examination was seropositive in the screening, but in the confirmatory analysis, carried out in reference laboratories, were negative, given that only the positive results were found in the Blood Bank database.

Results

Thanks to the data obtained, it can be seen that the donor Blood Bank of the Dr. Carlos Luis Valverde Vega Hospital, in general, has maintained constant donation numbers throughout the five-year period under study and constant numbers of permanently deferred donors associated to a positive screening test for a marker of an infectious diseases. The following Tables 1-5 presents the data describing the results obtained.

Table 1 General distribution of blood donors received at the Bank of Sangre del Hospital Dr. Carlos Luis Valverde Vega, between the years 2015 and 2019, of according to your condition for blood donation

Year	Condition accepted	Temporarily deferred	Permanently deferred	Total	% Deferred donors
2015	590	220	15	825	28,5
2016	597	265	17	879	32,1
2017	526	240	19	785	33,0
2018	516	294	6	816	36,8
2019	728	389	20	1137	36,0

Table 2 Relative distribution of blood donors received at the Bank of Blood from Hospital Dr. Carlos Luis Valverde Vega, according to the type of donation and condition, between the years 2015 and 2019

Year	Accepted donors			Temporarily deferred donors			Permanently deferred donors		
	Voluntary (%)	Replacement (%)	Total (%)	Voluntary (%)	Replacement (%)	Total (%)	Voluntary (%)	Replacement (%)	Total (%)
2015	52,1	19,4	71,5	7,5	19,2	26,7	0,5	1,3	1,8
2016	46,3	21,6	67,9	13,5	16,6	30,1	0,8	1,1	1,9
2017	46,6	20,4	67,0	3,2	27,4	30,6	0,1	2,3	2,4
2018	47,7	15,6	63,2	12,4	22,4	34,8	0,0	2,0	2,0
2019	46,0	18,0	64,0	9,1	24,5	33,5	0,5	1,9	2,5

Table 3 Reasons for permanent rejection for deferred donors of the Bank of Blood of Hospital Dr. Carlos Luis Valverde Vega, between the years 2015 and 2019

Year	Permanently deferred donors		
	Because Serology	Because other means	Total
2015	14	1	15
2016	16	1	17
2017	15	4	19
2018	15	1	16
2019	24	4	28

Table 4 Number of positive screening serological tests for infectious diseases of importance in blood bank, in donors permanently rejected received in the Blood Bank of the Hospital Dr. Carlos Luis Valverde Vega, between the years 2015 and 2019

Year	Screening test performed						
	HBsAg	Anti HB CORE	Anti HIV	Anti HTLV	Anti Chagas	Anti HCV	VDRL
2015	1	9	1	1	0	1	1
2016	3	8	0	1	0	3	1
2017	0	11	0	0	1	1	2
2018	2	5	0	5	2	0	1
2019	0	15	2	2	3	1	1
Total	6	48	3	9	6	6	6

Table 5 Confirmed cases and prevalence of serological tests in seropositive donors from the Blood Bank of Hospital Dr. Carlos Luis Valverde Vega, between the years 2015 and 2019

Analysis Performed	Positive Screening Result	Positive Confirmed Result	Total Blood Donors	Prevalence (%)
HBsAg	6	6	4442	0,14
Anti Hb CORE	48	44	4442	0,99
Anti HIV	3	1	4442	0,02
Anti HTLV	9	0	4442	0,00
Anti Chagas	6	0	4442	0,00
Anti HCV	6	2	4442	0,05
VDRL	6	5	4442	0,11

Discussion

The first data to be interpreted are those related to the number total blood donations. Between the years 2015 and 2018 these remain constant in approximately 800 per year, with a marked increase in 2019 with more than of 1,100 donations. However, it is interesting to note that, although the total of donors was constant over time, at least between the years 2015 and 2018, the percentage of rejected went from 28.5% to 36.8%, that is, almost 10% more in just 4 years. Curiously, in 2019, despite receiving almost 300 more people, the percentage of deferred decreased.

Most of the accepted donors were volunteers (almost 70%). This deferred donor status was, in its vast majority, in the category of temporary rejection. This means that all these rejections were given by a failure to comply with the basic donation requirements or by inadequate values, either in the pre-donation tests (blood pressure, temperature, weight) or blood samples tests (low hemoglobin / hematocrit, low platelets, high leukocytes, among others). The condition of permanently deferred donors remained constant in the five years studied, approximately 15 to 20 people per year. The total permanently deferred donations due to replacement donation was never less than 58%, with exceptional years such as 2017, with a percentage close to 95% or 2018, where all permanently deferred Donors were for replacement donation. These data present the clear difference between the quality from voluntary donors and replacement donors; both for the percentage of donations accepted between both profiles, as well as the percentage of donations rejected, temporarily and permanently, when comparing both of them.

The majority of permanently deferred donors (80%) was due to sero-positivity in serological tests of routine screening. It should

be remembered that, among the options for permanently reject a blood donor, in addition to a test serological by positive screening, are: hematological diseases such as leukemias, lymphomas or myelodysplastic syndromes, melanoma, injection drug abuse, alcoholism, medical conditions such as aneurysms, severe asthma, cirrhosis, dementia, endocarditis or autoimmune diseases, people with risky sexual behaviors like homosexual men, sex workers, among others.

The main infectious marker responsible for the majority of rejections, was the Anti HB CORE. This antibody is generated by contact with the core antigen of the virus and functions as a marker of resolution or previous infection with hepatitis B virus. However, HBsAg was not as noticeable as Anti HB CORE. In the age range studied, in total, only 6 donors presented this serological marker. If Anti HB CORE had not been used, more than 40 donors would have been able to complete the blood donation, with the associated risk in these blood units for patients.

It needs to be said that, of the 48 presumptive positive cases by HB Core, 44 were confirmed by full panel of hepatitis B. These 4 cases, false positives, possibly due to a low reading value of the automated equipment or to some interference of the sample that will cause the elevation of the real value. On the other hand, all HBsAg analyzes were subsequently confirmed with the panel full of hepatitis B. This speaks highly of the sensitivity of the test used for screening.

Antibodies for the HTLV I/II were the next cause of rejection, followed by Anti HCV, Anti Chagas and VDRL. However, all samples of donors for HTLV Virus and Chagas Disease were classified as negative in the confirmatory test. Hepatitis C Antigen, the confirmatory test for Hepatitis C, yielded only 2 confirmed reports of the 6 samples

sent. The FTA analysis performed to confirm the presence of anti treponemal antibodies obtained 5 out of 6 confirmations. Of the 3 HIV positive cases reported, only one was confirmed by Western Blot. False positives are reported possibly due to interference with the sample, hence the importance of reference laboratory confirmation.

Using these confirmatory values, the real prevalence was obtained for each disease, as shown in Table 4. Using as a reference similar work in Costa Rica,⁶⁻⁹ it is notable that the prevalence reported in this work are close to those reported in previous studies. The prevalence of Anti HB CORE is the highest, with a value of 0.99%, close to the reported in the Hospital Nacional de Niños Dr. Carlos Saenz Herrera, of 1.7%. Studies carried out between 1972 and 1985,¹⁰ described a prevalence of 0.5 to 1.0%, predominantly in the Districts of San Ramon and Palmares, which are the closest to the Blood Bank studied, so we can conclude that the prevalence for Hepatitis B has been constant across the years in this region.

These percentages show that the health system in Costa Rica is a great example to follow, given that across the Latin American region the prevalence for these diseases are much higher.^{4,5,11-13} As a last remark point, it must be said that the blood bank profile should be directed towards increasing and encouraging voluntary donation, this way ensuring the safety and quality of the blood components needed.

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None.

Conflicts of interest

The authors declare there are no conflicts of interest.

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