Blood discard rate and the prevalence of infectious and contagious diseases in blood donors from provincial towns of the state of Paraná, Brazil

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Background: So that an improvement in the selection of donors can be achieved and the risk to the recipient of transfused blood can be reduced, prospective donors are submitted to clinical and serological screening.

Objective: This study investigated the blood discard rate and the rate of infectious and contagious diseases in blood donors from provincial towns of the state of Paraná, Brazil.

Methods: This study was an exploratory cross-sectional descriptive investigation with a quantitative approach of donations between January and December 2011.

Results: In the study period the Regional Blood center in Maringá, Brazil received 8337 blood donations from people living in the city and neighboring towns. However, 278 (3.33%) donations were discarded during serological screening owing to one or more positive serological markers. A total of 46.4% of the discarded blood units were confirmed positive by serology with anti-HBc being the most common (66.7%), followed by syphilis (22.5%), HBsAg (4.7%), anti-hepatitis C virus (3.1%), human immunodeficiency virus (1.5%) and Chagas’ disease (1.5%). The rate of infectious-contagious diseases that can be transmitted by blood transfusions was 1.55% (129/8337) of the donor population with a frequency of 1.03% for anti-HBc and 0.35% for syphilis.

Conclusion: This study demonstrates a high prevalence of the anti-HBc marker in prospective blood donors from provincial towns in the state of Paraná, Brazil.

Keywords: Hemotherapy service; Serology; Blood bank; Quality control; Blood donors/statistics & numerical data; Blood safety; Hepatitis C/blood; Biological markers; Brazil

Introduction

Blood donation is one of the noblest gestures a human can make when its purpose is to save lives⁵. Although blood transfusions were seen as a mere transmission of physiological material, changes occurred that made the screening of donors highly relevant to the quality of blood. Since the start of the practice, blood donation in Brazil has changed from donors being paid to life-saving volunteers⁶.

Blood donation in Brazil is currently regulated by the Health Ministry through the National Health Surveillance Agency (ANVISA) by Resolution number 57 of the Collegiate Directory published on December 16th, 2010 and by Decree 1353 of the Health Ministry of June 13th, 2011 that standardize the technical norms for procedures in blood centers. These regulations support all the activities of blood centers in Brazil according to the principles and guidelines of the Brazilian policy for the transfusion of blood, components and blood-derived compounds. In fact, the regulations aim to protect donor and recipient, control collection, processing, storage, distribution and the transfusion of blood and its components and derivatives of human venous and arterial blood and establish essential institutional norms for the adequate execution of these activities⁷. So that an improvement in the selection of donors can be achieved and the risk to the recipient of transfused blood can be reduced, prospective donors are submitted to clinical and serological screening⁸-⁹.

The Brazilian Health Ministry determined that all blood centers must apply highly sensitive tests for transmissible infections to decrease the risk of disease and to maintain the quality of donated blood. The laboratory tests that should be performed are for syphilis, Chagas’ disease, hepatitis B virus (HBV), hepatitis C virus (HCV), acquired immunodeficiency syndrome (AIDS) and human T cell lymphotropic virus (HTLV) types I and II

The blood unit discard rate in Brazil ranges between 10 and 20%. Infectious diseases are the main cause of this high percentage, which exceeds that of developed countries⁰. The current research investigated the frequency of discarded blood and the prevalence of infectious-contagious diseases identified by positive serological markers in blood donors of the Regional Blood center in Maringá, Paraná, Brazil in 2011.

Methods

The current cross-sectional descriptive investigation with a quantitative approach collected data from the HEMOVIDA system which is used to store all the information about donated blood. Data were collected between 1st January and 31st December 2011. The variables...
investigated were age, gender, ethnic group, schooling, marital status, place of residence, profession and the serological tests for infectious diseases as defined by the Brazilian Health Ministry.6

Within the context of serological screening by the Blood Center, Decree 153/2011 of the Health Ministry states that each donation must be evaluated using highly sensitive tests for determined serological markers that would impair the health of the recipient. These tests include markers that detect the HBV surface antigen (HBsAg) and antibodies against HBV capsid (anti-HBc - IgG or IgG + IgM), HCV markers that identify antibodies against HCV or detect the antibody and antigen combined and two distinct tests are made for AIDS, one to detect the antibody against HIV I and II and the other to detect the antibody against HIV and the p24 antigen. Moreover, the test for the anti-Trypanosoma cruzi antibody which causes Chagas’ disease is carried out as are tests for syphilis to determine the anti-Treponema pallidum antibody or non-treponemal antibody and tests to detect antibodies against HTLV-I and -II. All methods of serological screening followed the manufacturer’s instructions.

The inclusion criterion for the current study was all discarded blood due to confirmed positive markers during serological screening. Serology with undetermined results and the absence of the donor for a repeat collection of blood to confirm initially positive serological tests were valid criteria for sample exclusion.

Data was collected between January and February 2012. Data were organized on a Microsoft Office Excel sheet in tables.

This study was developed according to the Decree of the National Health Council 196/1996, after approval of the Commission that Regulates Academic Activities in the Hospital Regional de Maringá and of the Ethics Committee on Research on Human Beings of the Universidade Estadual de Maringá (UEM: # 211/2011).

### Results

The Blood center of Maringá received 8337 blood donations from people living in the city of Maringá and in neighboring towns between 1st January and 31st December 2011. However, 278 blood units (3.33%) failed serological screening as they were positive for one or more serological markers. Data were collected at two distinct stages, namely, selection and confirmation of exclusion as shown in Tables 2 and 3.

### Table 2 - Blood discard due to positive serology of blood donors at the Regional Blood center of Maringá, Maringá, Paraná, Brazil in 2011

| Serological marker | Discarded blood units (n) | Discarded blood units/total donations (%) | Discarded blood units per serological marker (%) |
|--------------------|---------------------------|------------------------------------------|-----------------------------------------------|
| Anti-HBc           | 146                       | 0.17                                     | 52.50                                         |
| HBsAg              | 10                        | 0.12                                     | 3.60                                          |
| Anti-HCV           | 39                        | 0.46                                     | 14.00                                         |
| HIV                | 16                        | 0.19                                     | 5.80                                          |
| Chagas’ disease    | 6                         | 0.07                                     | 2.10                                          |
| Syphilis           | 58                        | 0.70                                     | 20.90                                         |
| HTLV               | 3                         | 0.04                                     | 1.10                                          |
| Total              |                           | 278                                      | 3.33                                          |

HCV: Hepatitis C virus; HIV: Human immunodeficiency virus; HTLV: Human T cell lymphotropic virus

### Table 3 - Discarded blood unit confirmation due to positive serological type and infectious-contagious diseases in blood donors at the Regional Blood center of Maringá, 2011

| Serological marker | Discarded blood units (n) | Confirmed serology (n) | Positivity per marker (%) | Prevalence of infectious-contagious diseases (%) |
|--------------------|---------------------------|------------------------|---------------------------|------------------------------------------------|
| Anti-HBc           | 146                       | 86                     | 58.90                     | 66.7                                          |
| HBsAg              | 10                        | 6                      | 60.00                     | 4.7                                           |
| Anti-HCV           | 39                        | 4                      | 10.25                     | 3.1                                           |
| HIV                | 16                        | 2                      | 12.50                     | 1.5                                           |
| Chagas’ disease    | 6                         | 2                      | 33.30                     | 1.5                                           |
| Syphilis           | 58                        | 29                     | 50.00                     | 22.5                                          |
| HTLV -I and -II    |                           | 3                      | 0.00                      | 0.00                                          |
| TOTAL              |                           | 278                    | 129                       | 22405                                         |

HCV: Hepatitis C virus; HIV: Human immunodeficiency virus; HTLV: Human T cell lymphotropic virus

During the screening stage, the Anti-HBc marker was the cause of 52.5% of the discarded blood units during serological screening, followed by syphilis (20.9%), anti-HCV (14.0%), HIV (5.80%), HBsAg (3.60%), Chagas’ disease (2.10%) and HTLV-I and -II (1.10%). The confirmation of exclusion due to serological results was based on specific criteria listed in Decree 1353/2011 of the Brazilian Health Ministry.

Table 3 shows the absolute frequency of confirmed serological types, the positivity of the marker and the prevalence of infectious-contagious diseases of blood donors.
This analysis shows that 129 (46.4%) out of 278 discarded blood units were confirmed positive by serology. Anti-HBc (66.7%) was the greatest cause of discard followed by syphilis (22.5%), HBsAg (4.7%), anti-HCV (3.1%), HIV (1.5%) and Chagas’ disease (1.5%).

The prevalence of infectious and contagious diseases among donors of the Regional Blood Center was 1.55% (129/8337).

The epidemiological profile of donors with positive serology was evaluated after confirmation (Table 4). The data relate to 122 donors, but there were 129 confirmed positive serology tests as more than one positive blood sample was submitted by some donors.

### Discussion

The Regional Blood center of Maringá is part of the state of Paraná’s network of blood centers called HEMEPAR. It collects blood from the 30 towns of the 15th Regional Health Area. The serology laboratory tests approximately 12,000 donors per year: 8500 donors are seen in the Blood Center and 3500 donors are seen in the Blood Collection and Transfusion Service of Cianorte. On average, some 100,000 tests/year are carried out (70,000 at the Regional Blood Center of Maringá and 30,000 at the Cianorte unit).

As blood centers have, as a rule, great difficulties in maintaining an ideal blood stock for emergencies and blood specificities, they adopt strategies to recruit donors(9). Consequently, it is very important to know the profile of people who donated blood but were considered inappropriate for donation so that blood donation safety is ensured. In fact, such knowledge is the basis to develop specific strategies to improve the technology in the selection of donors and to improve blood quality(10).

It is mandatory that blood centers have pre-transfusion strategies for the proper conditioning of blood products to reduce health risks to both donors and recipients alike(7).

According to ANVISA, the serological screening of potential blood donors is mandatory due to the great variety of transmittable pathogens(11). The current study shows that 52.5% of discarded blood units during the serological screening process were positive for the Anti-HBc serological marker with 66.7% of these being confirmed.

In fact, according to one study, a blood center in the state of Acre, Brazil also had a high prevalence for HBV. In this particular study, reactivity to anti-HBc reached 54.8% of discarded blood units which confirms the high prevalence of the virus in the population(12). This fact has been corroborated by a similar study in the Blood Center of Campo Mourão, Paraná, Brazil in which the serological rate for HBV (anti-HBc) reached 71.3% of discarded blood units(13).

Of the 129 confirmed serology tests, 4.7% were positive for HBsAg giving a prevalence of 0.07% in the population. This result fails to corroborate studies performed in the states of Rio Grande do Sul(14) and Maranhão, Brazil(15), with prevalences of 0.18% and 0.24%, respectively.

The prevalence of syphilis at the Regional Blood center of Maringá was 0.35%, lower than the mean of 0.65% in Caxias do Sul, Rio Grande do Sul, Brazil(14). Similar results were found in towns of the same state; Cruz Alta(16) and Santa Maria(17) with prevalences of 0.3% and 0.48%, respectively. The positivity rate for the pathology in Guarapuava, Paraná(18) according to the immune-enzyme test was 2.1%, thus a higher rate than that reported in the current study. Research in blood centers of other states also showed a high positivity rate for syphilis tests, such as those in the Brazilian states of Amazonas(19), São Paulo(7) and Sergipe(20).

The prevalence of anti-HCV was 0.04% in current study similar to that found by Perz(21) in the UK and Scandinavia (between 0.01% and 0.1%) and less than that reported in Rio de Janeiro (0.7%)(22).

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Table 4 - Epidemiological data of donors (n = 122) with positive serology in the Blood center of Maringá, Maringá, Paraná, Brazil in 2011

| Variable         | n  | %   |
|------------------|----|-----|
| Gender           |    |     |
| Male             | 66 | 54.1|
| Female           | 56 | 45.9|
| Marital Status   |    |     |
| Single           | 53 | 43.4|
| Married          | 52 | 42.6|
| Divorced/widower | 17 | 13.9|
| Ethnicity        |    |     |
| Caucasian        | 109| 89.3|
| Afro-descendent  | 10 | 8.2 |
| Oriental         | 3  | 2.5 |
| Schooling        |    |     |
| Not given        | 1  | 0.8 |
| Illiterate       | 1  | 0.8 |
| Basic education  | 40 | 32.8|
| High school      | 51 | 41.8|
| College degree   | 29 | 23.8|
| Age (years)      |    |     |
| 19-21            | 6  | 4.9 |
| 22-32            | 34 | 27.9|
| 33-43            | 32 | 26.3|
| 44-54            | 30 | 24.6|
| 55-65            | 20 | 16.4|
| Town             |    |     |
| Maringá          | 60 | 49.2|
| Paiçandu         | 7  | 5.7 |
| Florai           | 2  | 1.6 |
| Iguaraçu         | 1  | 0.8 |
| Sardeni          | 12 | 9.8 |
| Itambe           | 3  | 2.5 |
| Ivatuba          | 1  | 0.8 |
| Mandaguaçu       | 4  | 3.3 |
| Mandaguari       | 4  | 3.3 |
| Colorado         | 2  | 1.6 |
| Marialva         | 7  | 5.7 |
| Itapetinga       | 1  | 0.8 |
| Astorga          | 3  | 2.5 |
| Apucarana        | 1  | 0.8 |
| Atalaia          | 3  | 2.5 |
| Cruzeiro do Oeste| 1  | 0.8 |
| California       | 2  | 1.6 |
| Munhoz de Melo   | 1  | 0.8 |
| Nova Esperança   | 3  | 2.5 |
| Ourizona         | 1  | 0.8 |
| Paranacity       | 1  | 0.8 |
| Santo Inácio     | 1  | 0.8 |
| São José dos Pinhais | 1 | 0.8 |
The risk of HIV transmission by transfusion in Brazil has decreased from 4.4% at the start of the epidemic to 2.7% in 1992 to 0.4% in 2007\(^\text{[23]}\). The positivity rate in the current analysis was 0.02% for the same year as that of the study at the Regional Blood Center of Pelotas, Rio Grande do Sul, Brazil (HEMOPEL) at 0.08% between 2004 and 2007\(^\text{[24]}\).

The prevalence of Chagas’ disease among donors was relatively low (0.02%) when compared to the 0.31% reported whereas it declined to 0.1% during the 2002-2008 period\(^\text{[27]}\). Minas Gerais which assessed the prevalence of HTLV-I and II study and it should be emphasized that infection by the virus is the quality of services provided.

Serological screening for HTLV-I and -II at blood centers became mandatory only in 1993 due to great risks of transmission by blood transfusions\(^\text{[26]}\). No positivity occurred in the current study and it should be emphasized that infection by the virus is in sharp decline according to studies of blood donors in Uberaba, Minas Gerais which assessed the prevalence of HTLV-I and II between 1995 and 2008. The prevalence for 1995-2000 was 0.6%, whereas it declined to 0.1% during the 2002-2008 period\(^\text{[27]}\).

Conclusions

In conclusion, the frequency of discarded blood units due to positive serology is important to transfusion services as it allows the profiling of donors and identifies the prevalence of infectious diseases in a particular region. This study demonstrates the need for strict quality control that is able to minimize costs and increase the quality of services provided.

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