Epidemiological profile of hepatitis C in blood donors at the Uberaba Regional Blood center

Perfil epidemiológico para hepatite C em doadores de sangue do Hemocentro Regional de Uberaba

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ABSTRACT

The aim of the present study was to outline the serological profile of hepatitis C among blood donors seen at the Uberaba Regional Blood Center, Hemominas Foundation, over the last 14 years. The frequency of hepatitis C was compared between first-time and repeat donors and the epidemiological characteristics of those with positive and indeterminate ELISA anti-HCV (third and fourth generation) were analyzed based on the donor histories kept in the archives of the Uberaba Regional Blood Center. The serological ineligibility rate was 0.3%, with higher prevalence in the group of first-time donors. We did not find any significant differences regarding age, skin color, marital status or place of residence between eligible and ineligible donors; however, the frequency of positive serology was higher among men. The lower (0.3%) rate of ineligibility due to hepatitis C that was observed at the Uberaba Regional Blood Center, in relation to most Brazilian blood centers, is probably due to the large number of repeat donors (83.3%). This reinforces the importance of achieving donor commitment for increasing transfusion safety.

Key-words: Blood donor. Serological screening. Hepatitis C. Epidemiology.

RESUMO

O objetivo deste estudo foi traçar o perfil sorológico para a hepatite C nos doadores de sangue do Hemocentro Regional de Uberaba/Fundação Hemominas nos últimos 14 anos, comparando a sua ocorrência em doadores iniciais e de retorno e analisando as características epidemiológicas daqueles com ELISA anti-HCV (terceira e quarta geração) positivo e indeterminado, a partir dos históricos dos doadores nos arquivos do Hemocentro Regional de Uberaba. A inaptidão sorológica encontrada foi de 0,3%, com maior ocorrência no grupo de doadores iniciais. Não encontramos diferenças significativas quanto à idade, cor da pele, estado civil e local de residência entre os aptos e os inaptos, porém a ocorrência de sorologia positiva foi maior nos homens. A menor prevalência de inaptidão para hepatite C (0,3%) no Hemocentro Regional de Uberaba, em relação à maioria dos hemocentros do país, é provavelmente devido ao grande (83,3%) número de doadores de repetição, reforçando assim a importância da fidelização do doador para o aumento da segurança transfusional.

Palavras-chaves: Doador de sangue. Triagem sorológica. Hepatite C. Epidemiologia.

The hepatitis C virus (HCV) was identified in 1989 by Choo et al[5] and current estimates indicate that 130 million people worldwide are infected[7]. HCV is transmitted through infected blood and its derivatives, by means of percutaneous exposure (shared use of syringes by drug addicts, tattooing and accidents with biological material), and possibly through domestic or sexual contact with HCV-infected persons. In approximately 30% of hepatitis C cases, no risk factor can be identified[2]. Vertical transmission is rare when compared with hepatitis B; however, pregnant women with a high HCV load or coinfected with HIV are at greater risk of transmitting the disease to their children[14]. According to the World Health Organization, shared use of syringes by intravenous drug users is the main contamination route in developed countries, whereas blood transfusion continues to be the most important mechanism of HCV transmission in developing countries[7].

Although the symptoms of hepatitis C are similar to those of other viral hepatitis infections, 60 to 75% of HCV-infected individuals are asymptomatic and almost 20% show intermittent symptoms. The biochemical changes caused by hepatocellular dysfunction, such as elevated serum bilirubin and transaminase levels, are smaller in hepatitis C cases. Unfortunately, only a small percentage (about 20% of hepatitis C cases) are diagnosed based on the presence of symptoms or at random during voluntary blood donation, and large numbers of infected individuals remain undiagnosed[2 10].

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The most marked feature of hepatitis C is that the infection becomes chronic in most (50 to 85%) cases, because of the ability of the virus to develop mutations under the immunological pressure from the host, with rapid and continuous emergence of new strains called quasispecies and consequent evasion of the immune system. Thus, viral clearance is only observed in 15 to 50% of cases[4].

Since tests for detecting anti-HCV antibodies were developed and put on the market, many studies have determined the prevalence of HCV infection among the general population, mostly involving voluntary blood donors. Data from the Brazilian public blood center network showed that the prevalence of HCV infection among blood donors was 0.5% in 2002[1].

In view of the lack of recent studies conducted in our region, the objective of the present investigation was to determine the frequency of hepatitis C among first-time and repeat blood donors and to compare the demographic and social characteristics of ineligible (positive or indeterminate serology) and eligible (healthy) donors seen at the Uberaba Regional Blood Center/ Foundation and Center for Hematology and Hemotherapy of Minas Gerais (*Fundação Centro de Hematologia e Hemoterapia de Minas Gerais*; Hemominas Foundation), Minas Gerais, Brazil.

PATIENTS AND METHODS

Study population. All blood donors with a positive or indeterminate enzyme-linked immunosorbent assay (ELISA) anti-HCV test (third and fourth generation) who were seen at the Uberaba Regional Blood Center between November 1992 and December 2005 were studied, as explained in a previous paper[6]. The donors were first divided into first-time donors and repeat donors. The latter were defined as individuals who had donated blood previously and who had not shown any positive or inconclusive reactions to serological screening during previous donations. The following demographic and social characteristics of the donors were evaluated: gender (male and female), age (18 to 29 years and ≥30 years), skin color (white and nonwhite), marital status (single, married or other type of relationship) and place of residence (Uberaba or other municipalities). The study protocol was approved by the Ethics Committee of the Federal University of the Triângulo Mineiro (*Universidade Federal do Triângulo Mineiro*; UFTM) and the Hemominas Foundation.

Data collection. The data of the donors stored in the archives of the Uberaba Regional Blood Center were analyzed. The gender and age of the healthy donors (controls) were obtained from the database of the Blood Center. To analyze skin color, marital status and origin, a control group of 490 donors matched for the annual number of first-time and repeat donors who had been excluded due to hepatitis C (positive or indeterminate) was created. An indeterminate reaction was defined as an ELISA optical density result within the so-called *grey zone* (20% above or below the cutoff).

Statistical analysis. The results were analyzed statistically using the GraphPad InStat® program, version 3.06 (GraphPad Software, Inc, San Diego, CA, USA). Fisher's exact test, the chi-square test or odds ratios were used for comparisons between groups, and correlations were determined using Pearson's correlation coefficient, with the significance level set at $p < 0.05$.

RESULTS

A total of 171,027 blood donations were made between November 1992 and December 2005, and 561 of them were reactive to anti-HCV (0.3%). A significant change in the donor profile was observed over this period, with a significant increase in the number of repeat donors over the years ($p < 0.0001$). Repeat donors accounted for 49.4% of the donations at the center between 1993 and 1994 and 80.9% between 2004 and 2005, while the number of first-time donors did not show any significant trend of increases or decreases ($p = 0.81$; $r = 0.075$).

There was a gradual and significant decline in the number of donors excluded by a positive or indeterminate anti-HCV reaction over the period analyzed ($p = 0.0007$; $r = -0.814$) (**Table 1**).

Ineligibility among the donors was significantly related to first-time donors ($p < 0.0001$). With regard to gender, the ineligibility rate due to positive HCV serology was significantly higher among the men than among the women ($p = 0.0131$) (**Table 2**).

No significant differences were observed between age groups ($p = 0.5151$), skin colors ($p = 0.7434$), marital status ($p = 0.9067$) or places of residence ($p = 0.4934$) (**Table 3**).

TABLE 1

Number of blood donations at the Uberaba Regional Blood Center between 1992 and 2005 and number and frequency of donors with non-negative ELISA anti-HCV per year.

Year	Eligible donors (clinical trial)			ELISA anti-HCV positive or	Frequency
	first-time[1]	repeat[2]	total[3]	indeterminate	(%)[4]
1992*	611	84	695	5	0.72
1993	2,304	1,734	4,038	52	1.29
1994	2,008	2,473	4,481	36	0.80
1995	3,433	4,535	7,968	42	0.53
1996	3,637	6,745	10,382	48	0.46
1997	4,137	9,491	13,628	47	0.34
1998	3,770	12,080	15,850	68	0.43
1999	3,786	13,136	16,922	136	0.80
2000	3,316	13,680	16,996	27	0.16
2001	2,843	12,778	15,621	28	0.18
2002	2,697	13,195	15,892	19	0.12
2003	2,890	13,236	16,126	12	0.07
2004	3,083	13,084	16,167	22	0.14
2005	3,103	13,158	16,261	19	0.12
Total	41,618	129,409	171,027	561	0.33

*November and December (excluded from correlation analysis). [1]($p = 0.81$, $r = 0.075$), [2]($p < 0.0001$, $r = 0.878$); [3]($p = 0.0003$, $r = 0.839$), [4]($p = 0.0007$, $r = -0.814$). ELISA: enzyme linked imuno sorbent assay, Anti-HCV: anti-hepatitis C virus.

TABLE 2

Number of eligible donors in the Uberaba Regional Blood Center clinical trial and candidates with positive or indeterminate ELISA anti-HCV, according to gender and age.

	Anti-HCV Positive or indeterminate		Eligible			Odds
	nº	prevalence (%)	nº	%	p	ratio
Donors						
repeat	237	0.18	129,486	75.7	< 0.0001*	0.20-0.28
first time	324	0.78	41,541	24.3		-
Gender						
male	449	0.35	129,008	75.4	0.013*	1.10-1.61
female	112	0.27	42,019	24.6		-
Age (years)						
≥ 30	295	0.34	87,428	51.1	0.52	0.90-1.25
18-29	266	0.32	83,599	48.9		-

ELISA: enzyme linked imuno sorbent assay, Anti-HCV: anti-hepatitis C virus.

TABLE 3

Number of eligible donors control group and candidates with positive or indeterminate ELISA anti-HCV, according to skin color, marital status and municipality.

	Anti-HCV Positive or indeterminate		Eligible			Odds
	nº	prevalence (%)	nº	%	p	ratio
Skin color						
non-white	190	33.9	161	32.9	0.78	-
white	371	66.1	329	67.1		0.74-1.24
Marital status						
married	254	45.3	225	45.9	0.90	-
single	257	45.8	225	45.9		0.76-1.27
other	50	8.9	40	8.2		0.57-1.42
Municipality City						
others	82	14.6	80	16.3	0.50	-
Uberaba	479	85.4	410	83.7		0.82-1.59

ELISA: enzyme linked imuno sorbent assay, Anti-HCV: anti-hepatitis C virus.

DISCUSSION

The prevalence of hepatitis C seropositivity at Brazilian blood centers has decreased over recent years, with prevalences of 3.1% in Rio de Janeiro in 1990[11], 2.6% in Campinas in 1993[8] and 1.2% in Ribeirão Preto between 1996 and 2001[17], whereas this prevalence was 0.9% in Paraná in 2002[12]. The production reports from Brazilian blood centers have stated in 2002 that the ineligibility rates due to positive hepatitis C serology were 0.5% for the whole country and 0.5% and 0.2% in the southeastern region and in the State of Minas Gerais, respectively[1]. The rate at the Uberaba Regional Blood Center was 0.1%. At the Pro-Blood Foundation/Blood Center of São Paulo (*Fundação Pró-Sangue/ Hemocentro de São Paulo*) the prevalence of ineligibility due to hepatitis C fell from 1.8% in 1991 to 0.7% in 2001[16]. In the present study, the ineligibility rate was 0.3% between 1992 and 2005, with the observation of an evident decline over the years studied. Thus, 1% of the donations were discarded because of hepatitis C during the first three years, whereas this rate was only 0.1% during the last three years.

The progressive decline in the frequency of non-negative anti-HCV serology over the years that was observed in the present study is certainly related to the change in the blood donor profile that occurred at the Uberaba Regional Blood Center over the same period. The percentage of repeat donors almost doubled (49.4% in 1993/1994 versus 80.9% in 2004/2005). Similar results were found by Gonçalez et al[9] at the Pro-Blood Foundation/Blood Center of São Paulo. Salles et al[16] reported that long-term donor commitment, i.e. greater numbers of repeat donors, resulted in higher quality of blood available for transfusion.

The increased frequency observed in 1999 might be explained by changes that were made to the kit that had been used until that time, since similar results have been observed at the Uberlândia Regional Blood Center[15] and at the Belo Horizonte Blood Center (personal communication). It should be emphasized that the same serological kits are used at all public blood centers in the State of Minas Gerais (Hemominas Foundation), considering that the purchasing process is centralized.

In the present study, most of the blood donors found to be eligible through clinical screening were males (75.4%). This rate was similar to the rates reported by the National Agency for Sanitary Surveillance (*Agência Nacional de Vigilância Sanitária*; ANVISA) for Brazilian blood centers (74%) and for the State of Minas Gerais (71.6%)[1]. This finding demonstrates that women's participation as blood donors is poor. Nonetheless, analysis of the prevalence of serological ineligibility according to gender showed a significantly higher rate among men (p = 0.0131). Similar results have been reported by Valente et al[17] for the Ribeirão Preto Blood Center and by Patiño-Sarcinelli et al[13] in Rio de Janeiro. This indicates that men are more exposed to risk factors than women are, and supports the need to establish strategies that encourage women to donate blood.

Age analysis showed that 51.1% of the donors at the Uberaba Regional Blood Center who were found to be eligible through clinical screening were 30 years of age or over. Rates of 54% and 50.4% have been reported for Brazil and for the State of Minas Gerais, respectively[1]. Similarly to the findings of Paltanin[12], our results showed no significant association with age among the individuals who were ineligible due to HCV. However, this contrasts with other studies that demonstrated a higher rate of ineligibility among older subjects[3,13,18]. This difference might be explained by the longer duration of exposure to infection and poorer aseptic conditions of the medical instruments to which this population was subjected in the past. One explanation for the present findings might be the increased use of illicit drugs by today's youngsters and a reduction in the risk of transfusional transmission as a result of serological screening, considering that transfusion is a treatment more frequently applied to older age groups.

We did not observe any significant differences relating to skin color, marital status or place of residence between the control and ineligible groups. This suggests that, at least at the Uberaba Regional Blood Center, these factors are not associated with higher or lower risk of contamination.

In summary, we conclude that a) at the Uberaba Regional Blood Center, the profile of blood donors who were ineligible because of hepatitis C did not differ from the profile of eligible blood donors, in terms of age, skin color, marital status or origin; b) the higher frequency of ineligibility due to HCV among men suggests that they were more exposed to risk factors for infection than women were, thus supporting the need to establish strategies that encourage women to donate blood; and c) long-term donor commitment is of fundamental importance for ensuring the safety of blood used for transfusion.

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