Article/Artigo

Seroprevalence of cytomegalovirus antibodies in blood donors in southern, Brazil

Soroprevalência de anticorpos contra citomegalovírus em doadores de sangue do Sul do Brasil

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ABSTRACT

Introduction: Cytomegalovirus (CMV) infection is a matter of concern for blood bank professionals and blood transfusion recipients, especially in cases of transfusions to neonates and immunocompromised patients. Thus, the present study aimed to determine the seroprevalence of CMV IgG and IgM antibodies among blood donors in the City of Lages, in the mountain region of Santa Catarina, southern Brazil, and to investigate possible associations between the socioeconomic characteristics of donors and CMV serological status. **Methods:** A seroepidemiological cross-sectional study was conducted on 1,045 blood samples from donors that were used in serological screening over a one-year investigation. All the analyses were conducted using the microparticle enzyme immunoassay with Biokit® reagents (Barcelona, Spain), in accordance with the manufacturer's instructions. **Results:** Anti-CMV IgG seroprevalence in the sample studied was 96.4% (95% CI: 95.23 - 97.50) and that of anti-CMV IgM was 2.3% (95% CI: 1.39 - 3.20). There were no statistically significant associations between the presence of antibodies and the socioeconomic characteristics of donors. **Conclusions:** The blood donors in the study region had high seroprevalence of anti-CMV IgG. Thus, blood component screening strategies and careful indication for blood transfusions require special attention among healthcare professionals as part of the actions for prevention and reduction of primary infections caused by CMV.

Key-words: Cytomegalovirus. Blood donors. Seroprevalence.

RESUMO

Introdução: A infecção pelo citomegalovírus representa uma preocupação para os profissionais de bancos de sangue e para receptores de transfusões sanguíneas, especialmente em casos de transfusões para neonatos e pacientes imunocomprometidos. Assim, o presente estudo teve como objetivo determinar a soroprevalência de anticorpos IgG e IgM contra CMV em doadores de sangue da Cidade de Lages, Região Serrana de Santa Catarina, Sul do Brazil e investigar possíveis associações entre as características socioeconômicas dos doadores e a sorologia para CMV. **Métodos:** Trata-se de um estudo soroepidemiológico, transversal, conduzido com 1.045 amostras de sangue de doadores utilizadas na triagem sorológica durante um ano de investigação. Todas as análises foram conduzidas em ensaio imunoenzimático de micropartículas com reagentes Biokit® (Barcelona, Espanha), de acordo com as instruções do fabricante. **Resultados:** A soroprevalência de IgG antiCMV na amostra estudada foi de 96,4% (IC 95% 95,23 - 97,50) e de IgM antiCMV foi de 2,3% (IC 95% 1,39 - 3,20). Não houve associação significativa entre a presença de anticorpos e as características socioeconômicas dos doadores. **Conclusões:** Os doadores de sangue da região estudada apresentaram uma alta soroprevalência de IgG antiCMV, e assim, estratégias de triagem de hemocomponentes e a indicação criteriosa de transfusões sanguíneas requerem atenção especial dos profissionais da saúde como parte das ações de prevenção e redução da infecção primária pelo CMV.

Palavras-chaves: Citomegalovírus. Doadores de sangue. Soroprevalência.

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INTRODUCTION

Cytomegalovirus (CMV) infection is a matter for concern among blood bank professionals and blood transfusion recipients, especially in cases of transfusions to neonates and immunocompromised patients[1]. Transmission of CMV via blood transfusion and/or blood products is related to its latency in leukocytes and consequent contamination of red blood cells and platelet components, and the subclinical character of the infection in immunocompetent individuals[2].

Seroepidemiological studies have shown that CMV infection occurs in almost all regions of the world, and that its prevalence is inversely proportional to the socioeconomic status of the study population[3]. In general, the seroprevalence of CMV ranges from 40% to 60% in the northern hemisphere and from 80% to 100% in Africa and Latin America. In Brazil, the prevalence rates range from 65% to 85%[4,5].

Brazilian Ministry of Health Resolution 153/04, which provides the technical regulations for blood therapy procedures, determines that CMV serological tests should be performed on all blood units or blood products that are to be transfused into CMV-seronegative patients undergoing organ transplants and newborns weighing less than 1,200 g at birth, from CMV-seronegative mothers or mothers of unknown serological status. These serological tests are not required if such patients are transfused with leukocyte-depleted blood products[6].

To analyze the impact of CMV transmission in blood transfusions, it is necessary to determine the prevalence of prior exposure to CMV among blood donors and the percentage of seronegative individuals who are susceptible to infection. Since no data on the seroprevalence of CMV antibodies among the population of the State of Santa Catarina exists, this study aimed to determine the seroprevalence of anti-CMV IgG and IgM among blood donors in the City of Lages, Santa Catarina, southern Brazil. This study also aimed to investigate possible associations between the socioeconomic characteristics of donors and CMV serological status.

METHODS

A seroepidemiological cross-sectional study was conducted on blood samples from donors at the blood bank center of the mountain region of the State of Santa Catarina.

The study included all donors who were considered fit to donate, aged between 18 and 65 years, who attended the blood bank center for blood donation over the one-year study period. During this period, 6,844 candidates for donation were interviewed and of these, 3,649 were considered suitable for donation.

Samples from individuals who donated more than once during the study period were excluded in order to avoid interference in the statistical calculations of prevalence, and in investigating correlations with socioeconomic characteristics. Thus, 1,045 samples were analyzed in this study.

All the tests were performed by means of the enzyme-linked immunosorbent assay (ELISA), using Biokit® reagents (Barcelona, Spain) to detect anti-CMV IgG and IgM, in accordance with the manufacturer's instructions. Reactive samples were retested to confirm the results.

The donors were characterized after using analysis of variance. The prevalence of each antibody was defined as the percentage of reactive samples, and the standard error and 95% confidence interval (95% CI) were calculated for each prevalence rate.

All the data were tabulated and analyzed using the Epi-Info 6.4 and Stats Direct 2.3.5 statistical software. The chi-square test was used to investigate possible associations between the donors' socioeconomic characteristics and presence of CMV antibodies. Values of $p \leq 0.05$ were considered statistically significant.

Ethical

The study was approved by the Ethics Committee for Human Research of the Federal University of Santa Catarina (protocol 116/2003).

RESULTS

The prevalences of anti-CMV IgG and IgM in the study sample are shown in **Table 1**. **Table 2** shows the distribution of anti-CMV IgG results according to socioeconomic characteristics. Anti-CMV IgG was predominantly found among males, individuals who only completed elementary education and individuals aged 18 to 25 years old. Higher seropositivity was observed among repeat donors, with two to six previous donations. However, there were no statistically significant associations ($p > 0.05$).

Table 3 shows the distribution of anti-CMV IgM results according to socioeconomic characteristics. Although there were no statistically significant associations ($p > 0.05$), the presence of anti-CMV IgM was predominantly found among males, individuals with high school education and individuals aged 26 to 35 years. Just as for anti-CMV IgG, repeat donors (two to six previous donations) showed a higher prevalence of seropositivity for anti-CMV IgM.

TABLE 1 - Seroprevalence of anti-CMV IgG and IgM antibodies among blood donors in the mountain region of Santa Catarina, southern Brazil, between 2003 and 2004.

	Positive		Negative	Total
Antibody	n(%)	95% CI	n(%)	n (%)
anti-CMV IgG	1,007(96.4)	95.23-97.50	38(3.6)	1045 (100.0)
anti-CMV IgM	24(2.3)	1.39-3.20	1021(97.7)	1045 (100.0)

TABLE 2 - Distribution of anti-CMV IgG according to socioeconomic characteristics of blood donors in the mountain region of Santa Catarina, southern Brazil, between 2003 and 2004.

		Anti-CMV IgG		
		positive	negative	Total
Socioeconomic characteristics		n(%)	n(%)	n(%)
Sex	Male	684 (96.3)	26 (3.7)	710 (100.0)
	Female	323 (96.4)	12 (3.6)	335 (100.0)
Schooling level	Illiterate	1 (100.0)	0 (0.0)	1 (100.0)
	Elementary	445 (97.6)	11 (2.4)	456 (100.0)
	High School	354 (96.2)	14 (3.8)	368 (100.0)
	University	196 (94.2)	12 (5.8)	208 (100.0)
	Higher degree	11 (91.7)	1 (8.3)	12 (100.0)
Age (years)	18 to 25	372 (94.7)	21 (5.3)	393 (100.0)
	26 to 35	311 (98.1)	6 (1.9)	317 (100.0)
	36 to 45	217 (97.7)	5 (2.3)	222 (100.0)
	46 to 55	94 (94.9)	5 (5.1)	100 (100.0)
	56 to 65	10 (100.0)	0 (0.0)	10 (100.0)
	Other	3 (100.0)	0 (0.0)	3 (100.0)
Number of donations	1st donation	289 (97.6)	7 (2.4)	296 (100.0)
	2 to 6	551 (95.5)	26 (4.5)	577 (100.0)
	7 to 10	107 (96.4)	4 (3.6)	111 (100.0)
	11 or more	60 (98.4)	1 (1.6)	61 (100.0)

TABLE 3 - Distribution of anti-CMV IgM according to socioeconomic characteristics of blood donors in the mountain region of Santa Catarina, southern Brazil, between 2003 and 2004.

		Anti-CMV IgM		
		Positive	Negative	Total
Socioeconomic characteristics		n(%)	n(%)	n(%)
Sex	Male	17 (2.4)	684 (97.6)	701 (100.0)
	Female	7 (2.1)	337 (97.9)	344 (100.0)
Schooling level	Illiterate	0 (0.0)	1 (100.0)	1 (100.0)
	Elementary	4 (0.9)	447 (99.1)	451 (100.0)
	High School	16 (4.3)	354 (95.7)	370 (100.0)
	University	3 (1.5)	208 (98.5)	211 (100.0)
	Higher Degree	1 (8.3)	11 (91.7)	12 (100.0)
Age (years)	18 to 25	8 (2.0)	395 (98.0)	403 (100.0)
	26 to 35	11 (3.6)	297 (96.4)	308 (100.0)
	36 to 45	4 (1.8)	218 (98.2)	222 (100.0)
	46 to 55	0 (0.0)	99 (100.0)	99 (100.0)
	56 to 65	1 (10.0)	9 (90.0)	10 (100.0)
	Other	0 (0.0)	3 (100.0)	3 (100.0)
Number of donations	1st donation	4 (1.3)	297 (98.7)	301 (100.0)
	2 to 6	14 (2.4)	563 (97.6)	577 (100.0)
	7 to 10	4 (3.8)	102 (96.2)	106 (100.0)
	11 or more	2 (3.3)	59 (96.7)	61 (100.0)

DISCUSSION

In the present study, the seroprevalence of anti-CMV IgG in blood donors was 96.4%, which indicates a high rate of prior exposure to the virus. This result was higher than that found by Reis et al[7] in Rio de Janeiro, where the rate was 91.6%[7]. Similar studies in São Paulo (67.9%)[8] and Recife (71.9%)[9] also showed lower seroprevalence than in the present study. However, although higher than the seroprevalence in other Brazilian studies, this rate is in line with descriptions in the literature, in which the prevalence can reach 100%[4,5].

It should be noted that in the study sample, 3.6% of the donors were susceptible to primary infection with CMV, since they did not have anti-CMV IgG.

Regarding anti-CMV IgM the seroprevalence was 2.3%. Among the 24 donors seropositive for IgM, 23 were seropositive for IgG characterizing the sub acute phase of infection, while one donor was seropositive for IgM and negative for IgG, indicating current infection with CMV.

The seroprevalence of anti-CMV IgM in the present study was higher than what was found by Franco[9] in Recife, but lower than the findings of Biasoli[8] in São Paulo (1.5% and 2.9%, respectively).

Although no statistically significant association between the presence of antibodies and the donors' socioeconomic variables was found, the prevalance of anti-CMV IgG was higher among younger individuals (18 to 25 and 26 to 35 years), which contradicts the results from previous studies, in which this antibody was more prevalent in older age ranges[7]. Similarly, in the present study, anti-CMV IgM was more predominant among individuals with high school education, which differs from previous studies that highlighted an association between seropositivity and lower levels of education[10].

Thus, although there are no previous data on the prevalence of anti-CMV IgG and IgM in the population of the State of Santa Catarina, comparison of these data with studies conducted a few years ago in other States in Brazil allows us to suggest that CMV infection (even though asymptomatic) may be increasingly affecting younger age groups and a wider cross-section of the population. However, further studies are needed to confirm this suggestion.

Another fact to be considered is the higher seropositivity of antibodies among repeat donors, with two to six previous donations. This shows that loyalty among blood donors may not be related to a lower chance of positive anti-CMV findings, unlike what is generally observed regarding other infections of importance to blood bank centers, such as human immunodeficiency virus and hepatitis viruses B and C.

Regarding the demand for CMV-negative blood products, in accordance with ANVISA Resolution 153/046, we estimate that in order to obtain one seronegative blood unit, 28 units would need to be analyzed (given that the seronegative rate was found to be only 3.6%), thereby resulting in a high cost for serological screening in these cases. In this regard, further cost-effectiveness studies are needed in order to evaluate routine serological screening for CMV, in comparison with the use of leukocyte filters.

Since the number of donors who were seropositive for anti-CMV IgM (24 donors) was relatively small, their socioeconomic profile reported here must be interpreted with caution. It is known that CMV, like other herpesviruses, can remain latent for long periods, or remain in a state of non-replication or undetectable replication levels. Furthermore, there is the possibility that anti-CMV IgM titers may be falsely low or negative because of competition between high IgG antibody titers and antigens for binding sites, along with false-positive reactions resulting from rheumatoid factor, among others[11].

This study allows us to conclude that blood donors from the mountain region of Santa Catarina present high prevalence of anti-CMV IgG and, since no definitive treatment for this infection is known yet, strategies regarding blood component screening and rational blood use require special attention from healthcare professionals, as part of the actions for prevention and reduction of primary infections caused by CMV.

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CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

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