Epidemiology of hepatitis B virus infection in first-time blood donors in the southwestern region of Goiás, central Brazil

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Introduction: *Little is known about the epidemiology of hepatitis B virus (HBV) infection in populations from inner cities, especially in Central Brazil. Thus the objective of this study was to estimate the prevalence of HBV infection, and to analyze the factors associated with HBV infection, in a population of first-time blood donors in the southwestern region of Goiás, Central Brazil.*

Methods: *A total of 984 individuals were interviewed and gave blood samples to detect serological markers of HBV (HBsAg, anti-HBs, and anti-HBc) by enzyme linked immunosorbent assays.*

Results: *An overall prevalence of 6.9% was found for HBV, with constituent prevalence rates of 3.6% and 11.6%, in subjects classified as fit and unfit to donate blood according the epidemiological screening, respectively. Only three individuals were positive for anti-HBs alone, suggesting previous vaccination against HBV. The variables of prior blood transfusion (OR = 2.3), tattoo/piercing (OR = 2.1), illicit drug use (OR = 2.3), sex with a partner with hepatitis (OR = 14.7), and history of sexually transmitted diseases (OR = 2.9) were independently associated with HBV-positivity. These data suggested a low endemicity of hepatitis B in the studied population.*

Conclusion: *The findings of low hepatitis B immunization coverage and the association of hepatitis B with risky behavior highlight that there is a need to intensify hepatitis B prevention programs in the southwest region of Goiás.*

Keywords: *Hepatitis B /epidemiology; Hepatits B virus; Prevalence; Brazil*

Introduction

Hepatitis B virus (HBV) infection is a serious public health concern. Currently, there are approximately 350 million HBV carriers at risk of developing terminal hepatic diseases, such as cirrhosis and hepatocellular carcinoma.[1] The Brazilian Ministry of Health has estimated that 15% of the Brazilian population has been exposed to HBV and that 1% suffer from chronic diseases caused by this virus.[2] HBV can be transmitted through contaminated blood or other bodily fluids, via percutaneous or mucosal exposure.[3] As such, children born from women infected with hepatitis B,[4,5] individuals who have received multiple blood transfusions,[6] drug users,[7,8] and individuals with multiple sexual partners[9] are considered to be high risk groups for HBV infection.

The transmission pattern of hepatitis B varies across the world. In regions with a high prevalence of carriers [i.e., > 8% of population as carriers of the hepatitis B surface antigen (HBsAg)], infection patterns are vertical and horizontal/intrafamilial. In contrast, in regions with a low prevalence of carriers (< 2% carriers), adolescents and adults are mainly afflicted, as lifestyle plays the principle role in viral transmission. Regions that have intermediate endemicity (2-8% HBsAg carriers) show all forms of viral transmission.[3] Brazil is considered to be a region of low to intermediate endemicity.[10,11]

The Brazilian state of Goiás covers an area of 340,086 km^2 and has a population of 6 million inhabitants. It is the most populous state in the Midwest region of Brazil.[12] Its large size and geographic location has favored the influx of culturally and ethnically diverse migrants from other Brazilian states as well as from other countries. This diverse immigration contributes to the variable epidemiological patterns that exist within the state. With regards to HBV infection, the majority of studies have been conducted within the metropolitan region of Goiânia. Little information is available from rural areas of the state, though there are limited data that have been obtained from patients undergoing hemodialysis[13] and from quilombolo settlements.[14]

The purpose of this study was to estimate the prevalence of, and factors associated with, HBV infection in a population of prospective blood donors in the southwestern region of Goiás.

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The authors declare no competing financial interest

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Methods

This is an observational, cross-sectional, study performed on prospective blood donors from HEMOJATAÍ, the only blood collection point for the Jataí city (81,972 residents) and nine other cities in the southwestern region of Goiás (Aporé, 3,554 inhabitants; Caiapônia, 15,747 inhabitants; Chapadão do Céu, 5,289 inhabitants; Doverlândia, 8,344 inhabitants; Mineiros, 45,189 inhabitants; Perolândia, 2,748 inhabitants; Portelândia, 3,310 inhabitants; Santa Rita do Araguaia, 5,873 inhabitants; Serranópolis, 7,333 inhabitants).[12]

A total of 984 individuals participated in this study. To calculate the needed sample size, an HBV prevalence of 10.7% was assumed,[11] with a standard deviation of 3%, a design effect of 2.0, and 80% statistical power; the significance level was set at 95%. Data were collected between August 1st of 2008 and January 31st of 2009. All individuals who voluntarily came to HEMOJATAÍ for their first blood donation within the aforementioned period were included in the study. Individuals who were recruited to donate through businesses or the military were excluded from the study.

Data collection

Participants were first informed about the project and asked to sign an informed consent form prior to being interviewed. The interview was conducted using a standardized questionnaire designed to collect information on the participants' risk factors for hepatitis B and their sociodemographic data. The questionnaire included questions on the participants surgical, medical, and blood transfusion history. It also collected information on the presence of tattoos and piercings, the use of illegal drugs, unprotected sexual contact, prostitution (sex in exchange for money or gifts), history of sexually transmitted disease (STD), HIV tests, incarceration, and current or previous contact with an HBV infected partner.

Following administration of the questionnaire, a 10-mL peripheral venous blood sample was drawn from each participant. The blood samples were stored in test tubes and identified with a number corresponding to the participant's questionnaire. Blood serum was separated from the samples and stored at -20ºC until tested. Blood samples from prospective blood donors considered suitable for clinical screening were sent to the Blood Center Laboratory of Goiânia (HEMOG) for serological testing. Blood samples from candidates considered unfit to donate blood were sent to and tested at the municipal reference laboratory Euzevir de Carvalho, at the Dr. Serafim de Carvalho Municipal Health Center in Jataí, Goiás. At both laboratories, enzyme immunoassays (Bio-Rad Laboratories, Inc.) were utilized to test the blood samples for the following serological markers of HBV: HBsAg, total anti-HBc, and anti-HBs. The assays were performed in accordance with the manufacturer's specifications.

This study was approved by the Human and Animal Ethics Committee at the Hospital das Clínicas at the Federal University of Goias (UFG) and assigned protocol number 076/2008.

Data analysis

Infection rates were calculated with a confidence interval of 95%. Univariate analysis was performed for association of seropositivity to HBV (HBsAg or anti-HBc) with the variables studied. The variables showing statistical significance (p-value < 0.05) were included in a logistic regression model. Correlations were verified using chi-square and Fisher's exact tests where a p-value < 0.05 was considered statistically significant.

Results

The majority of prospective blood donors were male (55.6%), 40 years of age or younger (71.5%), had attained an average education level (77.2%), and had a monthly family income of more than R$ 1000 (73.6%). These characteristics are typical among blood donors in Brazil.

Of the 984 total prospective donors, 68 (6.9%) tested positive for the anti-HBc marker. This marker was associated with the presence of HBsAg in only 3/984 (0.3%) subjects and was associated with anti-HBs in 41/984 (4.2%) subjects. Also, in 24/984 (2.4%) subjects only the anti-HBc marker was detected. The three individuals who tested positive for anti-HBs had likely received a previous vaccination against hepatitis B (Table 1). Overall, positive HBV results varied in accordance with the clinical and epidemiological screening classifications. There was a 3.6% prevalence of HBV infection among subjects considered to be suitable blood donors based on their blood donor screening results, and an 11.6% prevalence of HBV-positive subjects among those classified as unsuitable donors (p < 0.01).

Table 1 - Prevalence of HBV serological markers in 984 first-time candidate blood donors of southwestern Goiás

Marker	n	%	95% CI*
Exposure			
HBsAg + anti-HBc	3	0.3	0.1-0.9
Anti-HBs + anti-HBc	41	4.2	3.0-5.6
Anti-HBc	24	2.4	1.6-3.7
Global (anti-HBc)	68	6.9	5.4-8.7
Vaccinated			
Anti-HBs in isolation	03	0.3	0.1-0.9

*95% confidence interval

Univariate analysis revealed that blood transfusion history, the presence of a piercing or tattoo, use of illegal drugs, unprotected sexual contact, sexual contact with a hepatitis carrier, history of prostitution, history of STD infection, and incarceration were associated with HBV

Table 2 - Analysis of variables associated with infection by the hepatitis B virus in 984 first-time candidate blood donors of Southwestern Goiás

Variable	HBV Pos/Total [a]	%	OR [b] (CI 95%)[c]	p-value
Clinical screening				
Fit donor	21/578	3.6	1.0	
Unfit donor	47/406	11.6	3.4 (2.0 - 5.9)	0.000
Gender				
Male	34/547	6.2	1.0	
Female	34/437	7.8	0.7 (0.5 - 1.3)	0.34
Age (years)				
18- 20	15/244	6.1	1.0	
21-30	16/243	6.6	1.1 (0.5 - 2.4)	
31-40	13/217	6.0	1.0 (0.4 - 2.2)	0.39[d]
41-50	11/119	9.2	1.5 (0.6 - 3.7)	
51-60	9/92	9.8	1.7 (0.6 - 4.2)	
> 60	4/69	5.8	0.9 (0.3 - 3.2)	
Transfusion history				
No	55/897	6.1	1.0	
Yes	13/87	14.9	2.68 (1.4 - 5.1)	0.002
Prior surgery				
No	67/974	6.9	1.0	
Yes	1/10	10.10	1.5 (0.2 - 12)	0.69
Previous Hospitalization				
No	65/950	6.8	1.0	
Yes	3/34	8.8	1.3 (0.4 - 4.4)	0.65
Piercing or tattoos				
No	28/603	4.6	1.0	
Yes	40/381	10.5	2.4 (1.4 - 4.0)	0.000
Illicit drug use				
No	56/915	6.1	1.0	
Yes	12/69	17.4	3.2 (1.6 - 6.4)	0.000
History of abortion				
No	28/381	7.3	1.0	
Yes	6/55	10.9	1.5 (0.6 - 3.9)	0.36
Unprotected sex				
No	40/798	5.0	1.0	
Yes	28/186	15.1	3.4 (2-5.6)	0.000
Sexual partner with hepatitis	59/964	6.1	1.0	
No	4/7	57.1	20.4 (4.5 - 93.5)	0.000
Yes				
History of prostitution				
No	56/931	6.0	1.0	
Yes	12/53	22.6	4.6 (2.3 - 9.2)	0.000
History of sexually transmitted disease				
No	51/903	5.6	1.0	
Yes	17/81	21.0	4.4 (2.4 - 8.1)	0.000
HIV testing				
No	65/961	6.8	1.0	
Yes	3/23	13.0	2.0 (0.6 - 7.1)	0.24
Prison sentence				
No	64/970	6.6	1.0	
Yes	4/14	28.6)	5.7 (1.7 - 18.5)	0.000

[a]denominator reflects the number of valid responses;[b]OR: Odds Ratio; [c] CI: confidence interval; [d]chi-squared for trend

infection (p-value < 0.01) (Table 2). These variables, as well as clinical screening, gender, and age, were subjected to multivariate analysis. Following the multivariate analysis, a blood transfusion history (adjusted OR = 2.3; CI 95%: 1.1-4.9), the presence of a piercing and/or tattoo (adjusted OR = 2.1; CI 95%: 1.2-3.7), the use of illegal drugs (adjusted OR = 2.3; CI 95%: 1.0-5.1), sexual contact with a hepatitis carrier (adjusted OR = 14.7; CI 95%: 2.7-80.7), and a history of STD (adjusted OR = 2.9; CI 95%: 1.4-5.9) remained independently associated to HBV infection. Furthermore, a history of prostitution was found to be marginally associated with HBV infection (adjusted OR = 2.1; CI 0.9-5.0) (Table 3).

Table 3 - Crude and adjusted analysis of risk factors independently associated with infection by hepatitis B virus in 984 first-time candidate blood donors of Southwestern Goiás

Risk factor	OR[a] crude (95% CI)[b]	adjusted OR [c] (95% CI)	p-value
Clinical screening			
Fit donor	1.0	1.0	
Unfit donor	3.4 (2.0 - 5.9)	1.5 (0.7 - 3.1)	0.27
Transfusion history			
No	1.0	1.0	
Yes	2.68 (1.4 - 5.1)	2.3 (1.1 - 4.9)	0.02
Piercing or tattoos			
No	1.0	1.0	
Yes	2.4 (1.4 - 4.0)	2.1 (1.2 - 3.7)	0.01
Illicit drug use			
No	1.0	1.0	
Yes	3.2 (1.6 - 6.4)	2.3 (1.0 - 5.1)	0.04
Unprotected sex			
No	1.0	1.0	
Yes	3.4 (2 - 5.6)	1.7 (0.8 - 3.5)	0.12
Sexual partner with hepatitis			
No	1.0	1.0	
Yes	20.4 (4.5 - 93.5)	14.7 (2.7 - 80.7)	0.002
History of prostitution			
No	1.0	1.0	
Yes	4.6 (2.3 - 9.2)	2.1 (0.9 - 5.0)	0.09
History of sexually transmitted disease			
No	1.0	1.0	
Yes	4.4 (2.4 - 8.1)	2.9 (1.4 - 5.9)	0.003
Prison sentence			
No	1.0	1.0	
Yes	5.7 (1.7 - 18.5)	2.7 (0.6 - 11.5)	0.19

[a] OR: Odds Ratio;[b]CI: confidence interval; [c] OR adjusted for gender, age, clinical screening, transfusion history, piercing tattoo, illicit drug use, unprotected sex, sexual partner with hepatitis, history of sexually transmitted disease, prostitution and prison sentence

Discussion

The process of ascertaining blood transfusion safety starts during the recruitment of prospective donors through clinical and epidemiological screening.[15] Thus, individuals who report a history of having received blood transfusions and/or of having behavioral risk factors for hepatitis B infection (i.e., having a tattoo and/or body piercing, using illegal drugs, having unprotected sex) are screened as unfit to donate blood. In the current study, screening indicated that 41% of the subjects were classified as unfit donors. HBV infection was 3.2 times more prevalent in this unfit group

than in subjects designated by the screening as being fit to donate (11.6% vs. 3.6%; $p < 0.001$). This difference confirms the importance of this screening strategy to ensure the safety of blood products for use in transfusion therapies.

It is noteworthy that the prevalence rate of current or previous HBV infection positivity in this study (6.9%) was higher than the prevalence rates found in blood donors from Manaus (4.8%, $p < 0.05$), São Paulo (4.3%, $p < 0.01$), and Salvador (4.0%, $p < 0.01$),[16] as well as those in blood donors from Rio de Janeiro (2.05%, $p < 0.01$)[17] and Santa Catarina (5.3%, $p < 0.05$).[18] On the other hand, the prevalence observed in this study was lower than that previously found in blood donors in the greater Midwest region of Brazil,[11] but similar to those reported recently in a population-based study conducted in the capital cities of the Midwest region (Goiânia, Campo Grande, and Cuiabá; 5.3%, $p > 0.05$).[10]

A weak association between HBV exposure markers and a history of blood transfusions was observed. However, it should be noted that the majority of the marker-positive subjects reported having undergone blood transfusions more than a decade prior to the study. As such, it is possible that these individuals received blood transfusions prior to the institutionalization of serological screening for HBsAg (1989) or anti-HBc (1993).[19,20] In fact, countries that have introduced these screening measures experienced a drastic reduction in cases of post-transfusion hepatitis B infection; nevertheless, HBV transmission remains the most common cause of viral infection acquired through transfusion.[21]

In areas of low endemicity for hepatitis B, infection typically occurs in adolescence and adulthood, when lifestyle is a determining factor in viral transmission.[3] In fact, the three individuals that tested positive for HBsAg were between the ages of 20 and 24. Even so, typical risk factors for hepatitis B infection that are associated with life style choices, such as having tattoos or body piercings,[22,23] use of illegal drugs,[7] and a history of STDs,[9] were independently correlated with HBV positivity in the present study. Furthermore, of the seven individuals who reported having HBV-positive sexual partners, four showed markers of HBV infection. One result that deserves particular attention is the extremely low frequency of subjects vaccinated against hepatitis B. Only three individuals demonstrated serological evidence of vaccination, although most of the people in the group were younger than 20 years of age, and therefore eligible for free hepatitis B vaccination in Brazil. Indeed, since 2004, hepatitis B vaccination has been mandatory for admission of students to state schools as well as to private elementary and secondary schools.[24]

Hepatitis B infection rates among blood donors are usually underestimated in relation to the general public; thus such extrapolations must be regarded with some caution. In this study, all prospective blood donors were included, regardless of their clinical and epidemiological screening results. Using this strategy, a low prevalence of hepatitis B infection would be estimated in a population of prospective blood donors from the southwestern region of Goiás. The present data confirm previous studies that have ranked Midwest Brazil as a region of low endemicity for hepatitis B.[10,11] Nonetheless, the low vaccination rates and the presence of risky behaviors found in these results highlight a need for improved health awareness and hepatitis B prevention programs in the urban areas of Goiás.

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