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COMPARISON OF RISK FACTORS AMONG BLOOD DONORS, VOLUNTEERS AND REPLACEMENT INDIVIDUALS, INFECTED OR NOT BY HEPATITIS C VIRUS

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ABSTRACT: Hepatitis C is transmitted primarily parenterally by contaminated blood and is often associated with: intravenous drug abuse, invasive procedures, blood transfusions, acupuncture, tattooing, and alcohol and tobacco use. This study aimed to quantify and evaluate the risk factors among blood donors, volunteer blood donors and replacement individuals, infected or not by the C virus. The main transmission routes of C virus were identified in 55 men and 25 women (GI) monitored by the Ambulatory Unit of the Department of Tropical Diseases, Botucatu Medical School, and in 24 men and 26 women (GII), all active blood donors at the Bauru State Hospital Transfusional Agency. Both groups were similar in: tobacco and alcohol consumption, sexual behavior, tattooing and illicit drug use. The duration of alcohol and tobacco consumption and blood transfusions in GI were longer, whereas the option for steady partners, condom use, disposable materials and piercings were predominant in GII. In conclusion, the risk factors for hepatitis C demonstrate the necessity of health policies that act on the primary and secondary prevention levels (respectively, reduction of infection incidence and hepatopathy risk).

KEY WORDS: hepatitis C, risk factors, blood donors, injectable drugs, tobacco, alcohol, marijuana, sexual behavior.

CONFLICTS OF INTEREST: There is no conflict.

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INTRODUCTION

There are many risk factors involved in hepatitis C virus penetration into the host body, mainly parenterally, in which there is a rupture on skin or mucous membrane continuity (1-23). This type of acquisition is related to invasive hospital treatments and occurs by use of non-disinfected or incorrectly sterilized materials and equipment. Risky procedures include use of the following: surgical instruments, contaminated needles and syringes, endoscopic equipment, acupuncture, hemodialysis, as well as organ transplants (currently in a significant low incidence) and hemocomponent transfusions (2, 15, 23-25). Hepatitis C virus is also transmitted through illicit parenteral and intra-nasal drug users, mirrors and inhalation straws contaminated by nasal and intranasal secretions, through shared use of personal devices such as razors and other blades, toothbrushes, cuticle nippers, as well as permanent tattoo applicators (1, 2, 23-26).

The virus may also be transmitted by sexual contact, the manner reported in 6 to 10% of the cases (18). The abuse of alcohol and tobacco is also related to the high incidence of hepatitis C. Both substances cause harmful effects on the liver of infected individuals and their chronic use may also result in immunosuppressive action that may lead to the evolution of hepatocellular carcinoma (19, 23). The present study aimed to identify, quantify and evaluate the risk factors among blood donors, volunteers and replacement individuals, infected or not by the C virus, specifically, its main transmission routes, epidemiology and prevalence in a specific group.

MATERIALS AND METHODS

The non-randomized, transversal clinical study was conducted from March 2003 to May 2004, among eighty volunteer blood donors, found to be infected by hepatitis C virus, monitored by the Tropical Diseases Outpatient Unit, Botucatu Medical School, UNESP. Three individuals that presented serological evidence of anti-HCV antibodies, determined by the Blood Bank of the Botucatu Medical School, were also grouped into GI. The risk factors for fifty normal individuals not infected by hepatitis C virus, were also analyzed. They were donors at the Bauru State Hospital Transfusional Agency – managed by Botucatu Medical School – and grouped into GII.

The research approach included male and female individuals over 18 years old, randomly inserted into each group, according to their previous medical records or blood donations. A demographic data instrument was employed to evaluate socioeconomic conditions, hepatitis C risk factors, epidemiology as well as occurrences with needles, injections, syringes or other non-disposable material, including any transfusions received up to 1989 (see Annex 1) (25).

Source Characterization

The individuals were distributed according to the estimated population of their city of origin. Population data were supplied by IBGE (Brazilian Institute of Geography and Statistics), Census 2004 (27). The number of inhabitants per city was divided into five categories: 1 – cities with up to 20,000 inhabitants; 2 – from 20,000 to 40,000; 3 – 40,000 to 100,000; 4 – from 100,000 to 200,000; and 5 – over 200,000 inhabitants.

Risk Factors

Parenteral infection may be due to blood transfusions, injections with non-disposable needles and syringes, use of injectable drugs, permanent tattooing or piercings. Sexual components – including condom use, number of sexual partners, promiscuity (homo- or heterosexuality) and sexually transmitted diseases (STD) – are also risk factors for hepatitis C infection. “Habits” refer to duration of tobacco use and daily consumption were taken into account. The weekly amount of alcohol ingested was converted into units: 600 mL of beer corresponded to 4 units/alcohol; 100 mL of sugarcane rum to 4 units/alcohol; 200 mL of mixed drink (gin, vodka, vermouth or other component) to 4 units/alcohol; a 100 mL dose of whiskey to 4 units/alcohol; and one glass of wine (150 mL) was equivalent to 1 unit/alcohol (28).

Diagnosis Confirmation

The diagnosis of hepatitis C infection was confirmed through ELISA serological test, at three different stages: the first before patients were sent to Outpatient Unit, according to routine procedures, and the other two during ambulatory monitoring. Polymerase chain reaction (PCR) was performed, and prior HCV positive serologies were confirmed.

Statistical Analysis

For quantitative variables, the mean (χ^2) and standard deviation were calculated for each group. Group comparisons were carried out using a t-test, calculating *t* and *p* statistics, for independent samples. Mann-Whitney nonparametric test was also employed in cases of high standard deviation. In these comparisons, whenever both tests had the same result the t-test was performed.

Regarding variables classified into more than two categories, the number of occurrences was recorded for each in GI, GII and in the juxtaposition of both groups. Comparison among groups was made by: chi-square test (χ^2) and calculation of *p* values. When classification reached ordinal scale, the number of occurrences was calculated in each group and in the juxtaposition of both, and comparison between GI and GII was performed through Mann-Whitney nonparametric test, for large samples, by calculating *z* and *p*. For binary variables ("Yes" or "No"; "Male" or "Female", among others), the number of occurrences of each class ("Yes", for example), its dimension and the total group frequency were registered. In both groups, the dimension of "Yes or No" occurrence was calculated by chi-square test (χ^2). Fisher's exact test was applied to some of the variables, with the direct calculation of *p* values, for data comparison. In all analyses, comparisons between GI and GII were significant when $p < 0.05$ (29).

All patients who took part in the present study had authorized the use of their data, and signed terms of free and informed consent. This study was approved by the Research Ethics Committee of the Botucatu Medical School on January 9th, 2003.

RESULTS

From March 2003 to May 2004, eighty individuals (GI) were studied, including 55 males and 25 females, between 18 and 70 years old (χ^2 40.21 ± 12.47), mostly from urban areas. Seventy of them (87.50%) resided in cities with less than 40,000 inhabitants and had tested positive for hepatitis C virus.

In GII, the fifty normal, volunteer blood donors investigated, mostly from the VI Regional Health Department, presented negative serology for hepatitis B and C viruses. Gender distribution was similar. Most GII subjects were from urban areas, living in cities with over 100,000 inhabitants.

GI presented most of the elderly individuals, with predominance of male gender and persons living in cities with fewer inhabitants. Urban area origin presented no statistical difference between the two groups.

Table 1 shows “Study Period”, “Schooling” and “Family Income” variables for both groups. The statistical analyses revealed that GI had less formal education and a lower schooling level than GII. Family income presented no difference between the groups.

The variables “Consumed Tobacco Amount” in units per day and “Tobacco Consumption Duration” in years are expressed in Table 2. There was no statistical difference for tobacco consumption between the two groups whereas GI individuals had consumed it longer. “Alcohol Consumption”, expressed in units per week, and “Alcohol Consumption Duration”, in years; presented no difference. However, the consumption duration was longer in GI.

The overwhelming majorities of GI and GII were heterosexuals, respectively 95% and 96% (Table 3). “Steady Partners” was higher in GII. Comparing single partners, statistics revealed similar values, with condom use predominant in GII. Sexually transmitted diseases (STD) were more frequent in GI than in GII. Among STD, gonorrhea and syphilis were predominant in the first group. Comparison of “Use of Disposable Material in Invasive Procedures”, including piercings and tattoos, verified that GII individuals always made use of disposable materials. Piercings were also more frequent in this group, while tattooing presented similar values.

Concerning drug abuse, Table 4 shows no difference between both groups. Hemocomponent transfusion was predominant in GI.

Table 1. Distribution of quantitative variables of the eighty individuals infected by virus C (GI) and fifty non-infected persons (GII), according to sociodemographic characteristics. Mean (χ^2) and standard deviation (s). Calculated statistics: *t*, *p* and *z*.

VARIABLES	GI Number (%)	GII Number (%)	TOTAL
Study Period (years)			
Illiterate	2 (2.50)	00	2
1 to 4 years	22 (27.50)	2 (4.00)	24
5 to 8 years	29 (32.25)	9 (18.00)	38
9 to 12 years	10 (12.50)	11 (22.00)	21
> 12 years	17 (21.25)	28 (56.00)	45
Total	**80 (100.00)**	**50 (100.00)**	**130**
Mean (χ^2) Standard deviation (s)	7.22 ± 4.24	11.3 ± 3.38	
Range	0 to 16 years	4 to 17 years	
Schooling			
Illiterate	2 (2.50)	00	2
IPS	37 (46.25)	9 (18.00)	46
CPS	14 (17.50)	2 (4.00)	16
ISS	3 (3.75)	3 (6.00)	6
CSS	16 (20.00)	16 (32.00)	32
ICD	4 (5.00)	13 (26.00)	17
CCD	4 (5.00)	7 (14.00)	11
Total	**80 (100.00)**	**50 (100.00)**	**130**

cont.

Family Income (R$)			
Up to R$ 300.00	10 (12.50)	3 (6.00)	13
R$ 301.00 to R$ 600.00	41 (51.25)	15 (30.00)	56
R$ 601.00 to R$ 900.00	13 (16.25)	16 (32.00)	29
R$ 901.00 to R$ 1200.00	9 (11.25)	7 (14.00)	16
Over R$ 1201.00	7 (8.75)	9 (18.00)	16
Total	**80 (100.00)**	**50 (100.00)**	**130**
Mean (χ^2) Standard deviation (s)	R$ 730.95 ± 604.87	R$ 899.76 ± 532.86	
Range	R$ 198.00 to 4500.00	R$ 240.00 to 3000.00	

Statistical analysis of Table 1

Variable	**Hypothesis**	**Significance Level**	**Comment**
Study Period	GI = GII	**p < 0.001**	**GI < GII**
Schooling	GI = GII	**p < 0.001**	**GI < GII**
Family Income	GI = GII	p > 0.10	GI = GII

GI: individuals infected by hepatitis C virus; GII: non-infected individuals.

IPS: incomplete primary school; CPS: complete primary school; ISS: incomplete secondary school; CSS: complete secondary school; ICD: incomplete college degree; CCD: complete college degree.

Table 2. Distribution of quantitative variables of the eighty individuals infected by C virus (GI) and fifty non-infected ones (GII), according to the amount and duration of tobacco and alcohol consumption. Mean (χ^2) and standard deviation (s).

VARIABLES	GI Number (%)	GII Number (%)	TOTAL
Tobacco Consumers	52 (65.00)	31 (62.00)	**83**
Tobacco Non-consumers	28 (35.00)	19 (38.00)	**47**
Total	**80 (100.00)**	**50 (100.00)**	**130**
Tobacco Consumption (units/day)			
No consumption	28 (35.00)	19 (38.00)	**47**
Up to 10 units	15 (18.75)	14 (28.00)	**29**
From 11 to 20 units	34 (42.50)	17 (34.00)	**51**
Over 20 units	03 (3,75)	00	**3**
Total	**80 (100.00)**	**50 (100.00)**	**130**
Mean (χ^2) Standard deviation (s)	11.75 ± 10.16	9.30 ± 8.63	
Range	10 to 40 units	5 to 20 units	
Consumption Duration (years)			
No consumption	28 (35.00)	19 (38.00)	**47**
Up to 10 years	15 (18.75)	26 (52.00)	**41**
From 11 to 20 years	17 (21.25)	5 (10.00)	**22**
Over 20 years	20 (25.00)	00	**20**
Total	**80 (100.00)**	**50 (100.00)**	**130**
Mean (χ^2) Standard deviation (s)	19.56 ± 9.16	7.77 ± 4.28	
Range	3 to 45 years	3 to 20 years	
Alcohol Consumers	56 (70.00)	28 (56.00)	**84**
Alcohol Non-consumers	24 (30.00)	22 (44.00)	**46**
Total	**80 (100.00)**	**50 (100.00)**	**130**

Alcohol Consumption (units/week)			
No consumption	24 (30.00)	22 (44.00)	**46**
Up to 10	21 (26.25)	10 (20.00)	**31**
From 11 to 20	14 (17.50)	5 (10.00)	**19**
From 21 to 40	8 (10.00)	8 (16.00)	**16**
From 41 to 80	7 (8.75)	2 (4.00)	**11**
Over 80	6 (7.50)	3 (6.00)	**9**
Total	**80 (100.00)**	**50 (100.00)**	**130**
Mean (χ^2) Standard deviation (s)	19.54 ± 28.37	15.12 ± 25.30	
Consumption Duration (years)			
No consumption	24 (30.00)	22 (44.00)	**46**
Up to 10 years	23 (28.75)	26 (52.00)	**49**
From 11 to 20 years	14 (17.50)	02 (4.00)	**16**
Over 20 years	19 (23.75)	00	**19**
Total	**80 (100.00)**	**50 (100.00)**	**130**
Mean (χ^2) Standard deviation (s)	17.75 ± 10.7	6.32 ± 4.48	
Range	2 to 40 years	2 to 20 years	

Statistical analysis of Table 2

Variables	Hypothesis	Significance Level	Comment
Consumed Amount	GI = GII	p > 0.10	GI = GII
Consumption Duration	GI = GII	**p ≤ 0.001**	**GI > GII**
Consumed Amount	GI = GII	p > 0.10	GI = GII
Consumption Duration	GI = GII	**p ≤ 0.001**	**GI > GII**

Table 3. Distribution of eighty individuals infected by C virus (GI) and fifty non-infected persons (GII) according to sexual behaviors – steady sexual partners (with or without) and single partner (yes or no) – as well as use of disposable materials, tattooing and piercing (yes or no).

VARIABLES	GROUPS AND VALUES			
	WITH	NUMBER	PROPORTION	TOTAL (with + without)
Steady Partner	GI	30	0.3750	80
	GII	29	0.5800	50
	Total	**59**	**0.4540**	**130**
	YES	NUMBER	PROPORTION	TOTAL (YES + NO)
Single Partner	GI	46	0.5750	80
	GII	35	0.7000	50
	Total	**81**	**0.6230**	**130**
	NO	NUMBER	PROPORTION	TOTAL (YES + NO)
Condom Use	GI	33	0.4124	80
	GII	9	0.1800	50
	Total	**42**	**0.3230**	**130**
	YES	NUMBER	PROPORTION	TOTAL (YES + NO)
Disposable Material	GI *	18	0.2250	80
	GII	26	0.5200	50
	Total	**37**	**0.3385**	**130**
	YES	NUMBER	PROPORTION	TOTAL (YES + NO)
Tattooing	GI	23	0.2875	80
	GII	14	0.2800	50
	Total	**37**	**0.2846**	**130**
	YES	NUMBER	PROPORTION	TOTAL (YES + NO)
Piercing	GI	8	0.1000	80
	GII	14	0.2800	50
	Total	**22**	**0.1692**	**130**

Statistical analysis of Table 3

Variable	Hypothesis	Significance Level	Comment
Disposable Material	GI = GII	**$p < 0.001$**	**GI < GII**
Tattooing	GI = GII	**$p > 0.50$**	GI = GII
Piercing	GI = GII	**$p < 0.01$**	**GI < GII**
Steady Partner	GI = GII	**$p < 0.025$**	**GI < GII**
Single Partner	GI = GII	$p > 0.10$	GI = GII
Condom Use	GI = GII	**$p < 0.001$**	**GI < GII**

Table 4. Distribution of eighty individuals infected by C virus (GI) and fifty non-infected persons (GII), regarding use of illicit drugs (injectable or intranasal) plus crack (yes or no).

VARIABLES	GROUPS AND VALUES			
DRUG USE	**YES**	**NUMBER**	**PROPORTION**	**TOTAL (YES + NO)**
Injectable Drugs	GI	20	0.2500	80
	GII	8	0.1600	50
	Total	**28**	**0.2154**	**130**
	YES	**NUMBER**	**PROPORTION**	**TOTAL (YES + NO)**
Intranasal Drugs	GI	19	0.2375	80
	GII	8	0.1600	50
	Total	**37**	**0.2077**	**130**
	YES	**NUMBER**	**PROPORTION**	**TOTAL (YES + NO)**
Crack	GI	8	0.1000	80
	GII	14	0.2800	50
	Total	**22**	**0.1692**	**130**

Statistical analysis of Table 4

Variable	Hypothesis	Significance Level	Comment
Injectable Drugs	GI = GII	$p > 0.10$	GI = GII
Intranasal Drugs	GI = GII	$p > 0.10$	GI = GII
Crack	GI = GII	$p > 0.50$	GI = GII

DISCUSSION

The prevalence of male individuals infected by C virus agrees with the literature (1, 3, 30). In the normal volunteer blood donor group, gender proportions were similar. The divergence found in the infected group may be due to campaigns to collect hemocomponents, accomplished by blood banks. When there is a shortage of blood derivatives in these institutions, young men recruited for the military are encouraged to donate blood and most of them maintain this practice afterwards. Some of the studied population may have participated in a blood donation campaign held in November 2003, on the occasion of the first anniversary of the Bauru State Hospital (31).

Comparison revealed no significant statistical difference between urban or rural origin and no reference was found in the literature concerning this feature. Elderly individuals were more predominant in the infected group. This finding agrees with demographic studies on volunteer blood donors, in which age presented similar figures among individuals infected by C virus (41 to 50 years old), while control the group was younger (from 21 to 30 years old) (23, 30, 32, 33). The current study showed that the control group had a more formal education than the infected one. Data from the southern Brazilian population also revealed that lower schooling level was directly related to higher for hepatitis C (34).

The two groups were socioeconomically homogeneous, although lower salaries limit access to better health assistance, and these individuals are less worried about diseases dissemination, treatment or prevention. Furthermore, exposure to the virus is higher, due to ignorance about its contamination routes and risk factors, which is consistent with data about C virus world prevalence, that compare population purchasing power (22, 25, 35, 36). GI individuals lived in smaller cities, compared to controls, who came from larger cities with better health services.

GI individuals were mostly technical professionals. On the other hand, infected individuals were more associated with domestic tasks that require no specialized knowledge. The literature, so far, does not mention any relation between C virus incidence and professional activity, nor does it report any virus transmission among construction workers or maids. Risk factors for these professions are hypothetically taken into account. A more detailed study on connecting these risk factors to C virus transmission is necessary. HCV incidence is low even among health workers, although their infection risk is significantly higher (37). Accidents with sharp instruments and professional exposure to materials containing C virus, as well as invasive procedures, may be related to the high prevalence of HCV seroconversion (16). Data also reveal possible unreported cases of cutting accidents involving health workers, a phenomenon that demands awareness and prevention campaigns as well.

Tobacco consumption duration was relevant among infected individuals, and expressive when time of use was over 10 years. Many studies relating severe steatosis and cirrhosis due to excessive tobacco use, reported that individuals infected by hepatitis C virus present higher prevalence of these diseases than non-tobacco users (11, 25, 38). Pessione *et al.* (11) observed that cigarette smokers, mostly young ones, had presented a significant augmentantion in damaged liver functions caused by chronic hepatitis**.**

Tobacco’s harmful effects, including its carcinogenicity to humans, were monitored in studies on causative factors of hepatocellular carcinoma (39). This occurred because the liver is highly susceptible to cigarette components and these compounds also affect the response to interferon treatment in individuals infected by the C virus (38). Even low concentrations of nicotine and other cigarette compounds do not minimize cytotoxic effects on the liver after long-term consumption (12).

Statistical data on alcohol consumption demonstrated homogeneity between the groups. The same results were found by Yu and Yuan (38), in which the amount of alcohol ingested, from “1 to 3 doses/day” – equivalent to 7 to 21 weekly units of alcohol – was not considered relevant. Alcohol consumption duration differed statistically, since most infected individuals had consumed alcohol for over 10 years. About alcohol’s damaging effects on the liver, especially of HCV-infected individuals, many authors were unanimous on its aggravating aspects (7, 11, 24, 25, 38).

No significant statistical difference regarding sexual orientation was registered. The probability of C virus transmission through sexual intercourse is considered low according to Strauss (15). However, Alter *et al.* (40) found a contamination incidence of 20% through sex when studying hepatitis C in blood donors. This type of transmission is considered uncommon, given that most infected individuals present more than one risk factor that can never be separately identified (5, 41). GII partners were less steady than the control group. According to Hepburn and Lawitz (42), the greater the number of sexual partners, the higher the probability of C virus transmission. Bosia *et al.* (43) suggested that having more than one sexual partner is not directly related to HCV infection.

Only a small portion of the infected individuals had used some kind of protective barrier during sexual intercourse whereas most of the controls had utilized condoms. On the correlation between severity of hepatic lesions and sexual transmission of hepatitis C virus, Drawan *et al.* (36) mentioned the need to train persons on sexual protection methods, not only concerning hepatitis prevention, but also contraception.

In the present study, most GII subjects presented STD, with a high incidence of gonorrhea and syphilis. However, Henderson (41) found contrary results in his meta-analysis on epidemiology and transmission routes of hepatitis C virus, in which the occurrence of these diseases was inversely proportional to C virus infection. The current data agrees with Oliveira *et al.* (8), who studied the virus prevalence and risk factors in drug users from Rio de Janeiro. Wejstal (20) took into account the infrequent occurrence through hepatitis C sexual transmission, and suggested further research on the main STD and their relation to hepatitis C virus.

Use of disposable materials in invasive procedures presented statistical difference between the studied groups. Bibliographical data showed that, before 1990, injectable medicines were administrated via non-disposable materials, boiled before reutilization. According to Labedzka, Simon and Gladysz (1), invasive surgical procedures are the main risk factors studied in clinical and epidemiological research of hepatitis C virus in volunteer blood donors. Any cutting or perforating procedure deserves attention to pathogen transmissibility (1, 14, 34, 44). Henderson (41) notes that health institutions should develop efficient preventive mechanisms against professional accidents that would lead to risk factors. The availability of individual protective equipment is legally guaranteed, so that health organizations who do not provide them may face legal sanctions.

In the current work, tattooing presented no statistical difference between GI and GII, a finding that contradicts the literature, in which tattooing is considered a risk factor for HCV infection (3, 13, 40, 45). This relevance may be due to obsolate techniques, when tattoos were applied with non-disposable non-sterilized equipment in inappropriate parlors, by persons who were not aware of disease epidemiology (3, 40). According to Haley and Fischer (44), the US Centers for Disease Control and Prevention do not recommend inspection in tattoo clinics, in view of previous studies conducted in such establishments, by this organization, that did not identify any virus presence.

Piercings were predominant in the control group. Only a few studies characterize piercings as risk factors for hepatitis C transmission, although they use perforating materials and their invasive application breaks the natural barrier against pathogens (1, 46, 47). The Hepatitis C Section of the Public Health Agency of Canada reported that only 4% of the nation's youth, from 12 to 29 years old, who used this type of adornment, had contracted HCV (48).

No statistical difference was observed herein between the two groups regarding use of illicit drugs. Data presented by US National Institutes of Health on management of hepatitis C showed that this type of risk factor must be distinguished from other manners of C virus dissemination, not only by parenteral transmission, but also by inhalation through nasal catheters (6). According to McMahon *et al.* (4), in a study on the virus presence in nasal secretions of drug users, substances commonly inhaled intranasally – such as cocaine, methamphetamine and heroin – may cause tissue deterioration or nasal membrane necrosis. Inhalation implements inserted in a damaged nasal cavity can transmit the virus, especially when used by many individuals including a infected person.

Injectable drugs constitute the major risk factor for hepatitis C in the United States (23). In Rio de Janeiro, Brazil, Oliveira *et al.* (8) reported high rates of cocaine consumption among injectable drug users, and high prevalence of hepatitis C infection in these individuals. Many authors affirm that illicit drug abuse is related to hepatitis C (8, 10, 17, 25). They recommend health programs directed to chemical dependence and control strategies to stop the virus dissemination.

Post-transfusion hepatitis used to be more frequent before 1989, when the C virus was discovered (13, 17, 24, 26). Until then, infected individuals could donate blood without knowing they were transmitting the disease. As technologies improved, new studies revealed that serological and control tests were extremely important to prevent this type of transmission (21). Nowadays, control rules established by governmental organizations have inhibited HCV transmission through blood transfusion by defining specific recommendations to donors (9). In the current study, even after adoption of such guidelines for blood donation, post-transfusion hepatitis was registered in GI individuals.

CONCLUSIONS

It was possible to verify that risk factors identified in blood donors infected by hepatitis C virus were similar to the literature, except for illicit drug use, which demands some attention to local customs and habits. Judicious donor selection, including precise serological tests, is also very important; given that risk factors are routinely present in general population, especially in the youngest portion. Thus, orientation campaigns are essential to prevent dissemination of the C virus, through health policies that act on the primary and secondary prevention levels (respectively, reduction of infection incidence and hepatopathy risks).

REFERENCES

1. Labedzka H, Simon K, Gladysz A. Clinical and epidemiological assessment of hepatitis C virus infection among voluntary blood donors. Med Sci Monit. 2002 ;8(8):591-6.

2. Lazzarini FAS, Andrade D, Rossi LA, Ferraz AEP. Incidência de soroconversão para o vírus da hepatite C após a implementação de programa de prevenção e controle em unidades de hemodiálise. Rev Lat Am Enfermagem. 2000;8(5):7-12.

3. Mathei C, Robaeys G, van Damme P, Buntinx F, Verrando R. Prevalence of hepatitis C in drug users in Flanders: determinants and geographic differences. Epidemiol Infect. 2005;133(1):127-36.

4. Mcmahon JM, Simm M, Milano D, Clatts M. Detection of hepatitis C virus in the nasal secretions of an intranasal drug-user. Ann Clin Microbiol Antimicrob. 2004; 3:6-10.

5. Memon MI, Memon MA. Hepatitis C: an epidemiological review. J Viral Hepat. 2002;9(2):84-100.

6. NHI Consensus statement on management of hepatitis C: 2002. NIH Consens State Sci Statements. 2002;19(3):1-46.

7. Oliveira LC, Buso AG, Oliveira AT, Arantes CA, Borges LV, Valente SR. Prevalence of hepatitis B and hepatitis C markers in alcoholics with and without clinically evident hepatic cirrhosis. Rev Inst Med Trop São Paulo. 1999;41(2):69-73.

8. Oliveira MLA, Bastos FI, Telles PR, Yoshida CFT, Schatzmayr MG, Paetzold U, Pauli G, Schreier E. Prevalence and risk factors for HBV, HCV and HIV infections among injecting drug users from Rio de Janeiro, Brazil. Braz J Med Biol Res. 1999;32(9):1107-14.

9. Organização Pan-Americana da Saúde e Organização Mundial da Saúde. 124ª Sessão do Comitê Executivo. Fortalecimento dos Bancos de Sangue na Região das Américas, abril 1999 [Internet]. [place unknown]; 2004 [cited 2004 Jul 09] . Available from: http://www.bases.bireme.br/chi-oms/cd124.16/iah/online.

10. Paltanin LF, Reiche EM. Seroprevalence of anti-hepatitis C virus antibodies among blood donors, Brazil. Rev Saúde Pública. 2002;36(4):393-9.

11. Pessione F, Ramond MJ, Njapoum C, Duchatelle V, Degott C, Erlinger S, Rueff B, Valla DC, Degos F. Cigarette smoking and hepatic lesions in patients with chronic hepatitis C. Hepatology. 2001,34(1):121-5.

12. Phillips CV, Wang C, Guenzel B. You might as well smoke; the misleading and harmful public message about smokeless tobacco. BMC Public Health. 2005;5:31-8.

13. Simmonds P, Zhang LQ, Watson HG, Rebus S, Ferguson ED, Balfe P, Leadbetter GH, Yap PL, Peutherer JF, Ludlam CA. Hepatitis C quantification in sequencing in blood products, hemophiliacs and drug users. Lancet. 1990;336(8729):1469-72.

14. Souza M, Vianna LAC. Incidência de acidentes de trabalho relacionada com a não utilização das precauções universais. Rev Bras Enfermagem. 1993;46(3-4):234-44.

15. Strauss E. Hepatitis C. Rev Soc Bras Med Trop. 2001;34(1):69-82.

16. Terrault N. Chronic viral hepatitis in the United States. American Association for the Study of Liver Diseases [Internet]. An update: viral hepatitis, October 2000. [cited 2003 Out 20]. Available from:http://www.hepnet.com/hepc/aasld00/terrault.html.

17. Vassilev ZP, Strauss SM, Astone J, Des Jarlais DC. Injection drug users and the provision of hepatitis C-related services in a nationwide sample of drug treatment programs. J Behav Health Serv Res. 2004;31(2):208-16.

18.Velasco M, Poniachik J, Alegria S, Brahm J. Transmisión familiar del virus de la hepatitis C en un grupo de población chilena. Rev Med Chile. 2003;131(10):1123-7.

19. Wang CS, Chang TT, Yao WJ, Chou P. Comparison of hepatitis B virus and hepatitis C virus prevalence and risk factors in a community-based study. Am J Trop Med Hyg. 2002;66(4):389-93.

20. WejstaL R. Sexual transmission of hepatitis C virus. J Hepatol. 1999;31:92 -5.

21. Wendel S, Luzzi JR, Russo C, Fontão RCL, Ghaname J. Pesquisa de anti-HBc em doadores de sangue em São Paulo: deverá esse teste ser adotado pelo Brasil? Rev Paul Med. 1991;109:77-83.

22. WHO. World Health Organization. Fact sheet n. 164: hepatitis C [Internet]. [cited 2004 Jun 18]. Available from http://www.who.int/inf-fact164.html.

23. Williams I. Epidemiology of hepatitis C in the United States. Am J Med. 1999;107(6B):2-9.

24. Choo QL, Kuo G, Weiner AJ, Overby LR, Bradley DW, Houghton M. Isolation of cDNA clone derived from blood-borne non-A, non-B viral hepatitis genome. Science. 1989;244(4902):359-62.

25. Gonçales Jr FL, Stucchi RS, Pavan MH, Escanhoela CA, Yamanaka A, Magna LA, Gonçales NS. A clinical, epidemiological, laboratorial, histological and ultrasonographic evaluation of anti-HCV EIA-2 positive blood donors. Rev Inst Med Trop São Paulo. 2000;42(3):147-52.

26. Coelho HS, Figueiredo FA, Segadas JÁ, Panaim VL, Nogueira CM, Silva CR, Mussi TJ. Evolutive aspects of post-transfusion hepatitis C. Review of 175 cases. Rev Soc Bras Med Trop. 1998;31(3):295-300.

27. Instituto Brasileiro de Geografia e Estatística. Análise das cidades brasileiras quanto à distribuição da população [Internet]. [cited 2004 Nov 04]. Available from http://www.ibge.gov.br.

28. Grupo dos Alcoólicos Anônimos de São Paulo. Índices e dosagens alcoólicas [Internet]. [cited 2004 May 14]. Available from http://www.gaasp.com.br.

29. Cury PR. Metodologia e análise de pesquisa em ciências biológicas. 2nd ed. Botucatu: Editora Tipomic; 1997. 315 p.

30. Armas-Merino R, Wolff Fernandez C, Soto Henriquez R, Jirón Vargas MI, Parraguez Abarca A. El virus C de la hepatitis y las enfermedades que produce. Rev Med Chile. 1999;127(10):1240-54.

31. Hospital Estadual Bauru. Eventos e Promoções [Internet]. [cited 2005 Jul 09]. Available from http://www.heb.bauru.unesp.br.

32. Focaccia R, Siciliano RF, Santos ED, Boccardo E, Conceição OJ, Barbosa UO, Galante VC. Hepatitis C: a critical analysis of therapeutic response predictors. Braz J Infect Dis. 2002;6(2):74-81.

33. Güemes MA, Chil OA, Estévez AV, Valverde CV. Comportamiento de la hepatitis C en donantes de sangre. Rev Cubana Hig Epidemiol. 2001;39(2):82-5.

34. Brandão AB, Fuchs SC. Risk factors for hepatitis C virus infection among blood donors in southern Brazil: a case-control study. BMC Gastroenterol. 2002;2:18.

35. Arraes LC, Ximenes R, Andrieu JM, Lu W, Barreto S, Pereira LMMB, Castelo A. The biological meaning of anti-HBc positive results in blood donor: relation to HBV-DNA and to other serological markers. Rev Inst Med Trop São Paulo. 2003;45(3):137-40.

36. Drawan VK, Wu GY, Talavera F, Brann OS, Mechaber AJ, Katz J. Hepatitis C (protocol for a Cochrane Review). In: The Cochrane Library Plus. Issue 16, 2004. Oxford: Update Software.

37. Figueiredo ECQ, Cotrim HP, Tavares-Neto J. Freqüência do vírus da hepatite C em profissionais da saúde: revisão sistemática da literatura. Gastroenterol Endosc Dig. 2003;22(2):53-60.

38. Yu MC, Yuan JM. Environmental factors and risk for hepatocellular carcinoma. Gastroenterology. 2004;127(5, Suppl 1):72-8.

39. ACS Quitting Smokeless Tobacco. American Cancer Society prevention and early detection [Internet]. [cited 2005 Sep 07]. Available from http://www.cancer.org/croot/content/Acessed.

40. Alter HJ, Conry-Cantilena C, Melpolder J, Tan D, van Raden M, Herion D, Lau D, Hoofnagle JH. Hepatitis C in asymptomatic blood donors. Hepatology. 1997;26(3 Suppl 1):29-33.

41. Henderson DK. Managing occupational risks for hepatitis C transmission in the health care setting. Clin Microbiol Rev. 2003;16(3):546-68.

42. Hepburn MJ, Lawitz EJ. Seroprevalence of hepatitis C and associated risk factors among an urban population in Haiti. BMC Gastroenterol. 2004;4:31-4.

43. Bosia JD, Rivero Altamiranda A, Coccozella DR, Diaz Velez L, Barrio M, Borzi S, Malca MI, Gonzalez JE, Munne MJ, Tonelli E, Fraquelli E, Curciarello JO. Sexual transmission of Hepatitis C virus. Acta Gastroenterol Latinoam. 2002;32(2):87-90.

44. Haley RW, Fischer RP. The tattooing paradox: are studies of acute hepatitis adequate to identify routes of transmission of subclinical hepatitis C infection? Arch Intern Med. 2003;163(9):1095-8.

45. Garassini Serra M, Garassini Chávez M. Hepatitis C: how is it transmitted? Can it be prevented? GEN. 2000;54:116-35.

46. Ferreira CT, Silveira TR. Viral hepatitis: epidemiological and preventive aspects. Rev Bras Epidemiol. 2004;7(4):473-87.

47. Gongora DVN. Serologic markers of hepatitis C virus infection among house-staff and patients of the dialysis unit of Hospital das Clínicas da Faculdade de Medicina da Universidade de São Paulo. Rev Soc Bras Med Trop. 1998;31:585-6.

48. Hepatitis C Division Health Canada. Special report on youth, piercing, tattooing and hepatitis C trendscan findings [Internet]. [cited 2005 Sep 08]. Available from http://www.healthcanada.ca/hepc.

ANNEX 1

unesp São Paulo State University

Botucatu Medical School Hospital – Tropical Diseases Outpatient Unit

COMPARISON OF RISK FACTORS AMONG BLOOD DONORS, VOLUNTEERS AND REPLACEMENT INDIVIDUALS, INFECTED OR NOT BY C VIRUS

1. IDENTIFICATION

Name: ____ ID ________________

Address: ____, N. _______

Quarter: ____________________________________ City: ___________________

ZIP Code: ______________________ Telephone: __________________________

2. SOCIODEMOGRAPHIC CHARACTERISTICS

Sex: ____________ Age: _______________ Civil state: ______________________

Schooling: _______________________ Study period (years): ______________

Area of origin: _______________________ Occupation: _____________________

Family income: _____________ /person – Number of people in the house: ________

3. RISK FACTORS – HABITS

Tobacco consumer: ______ Units/day _______ Duration (years): _________

Alcohol consumer: ________ Units/week _____ Duration (years): _________

Sexual activity:

Steady sexual partners: _______ With/without ____________ Time: ______

Single partner: Yes/No: ___________ Lifetime? ________________

Condom use: Yes/No: ________________ Consistently? _____________

Sexuality – Heterosexual: ______ Homosexual: _______ Bisexual: ________

Sexually transmitted diseases: Yes/No: ______Which? __________________

Use of disposable materials in invasive procedures: Yes/No: ________________

Use of piercing: Yes/No: ________________ Use of tattooing: Yes/No: _______

Use of illicit drug: Yes/No: _______ Injectable: Yes/No: ______Which? ___________

Intranasal: Yes/No: ______ Which? _____________ Crack: Yes/No: ____________

Another drug: Yes/No: ______Which? _____________

4. EPIDEMIOLOGICAL AND CLINICAL DATA

Clinical history

Hepatits C. Yes/No: ____

Jaundice: Yes/No: ____ Hepatocellular carcinoma: Yes/No: ____

Hemocomponent transfusion: Yes/No: _____ Why? __________________

How many bags? ________

HIV (infection or illness): Yes/No: _____

Familial antecedents

Hepatitis: Yes/No: ___ Which? _____ Who? _____________ (relationship)

Jaundice: Yes/No: ____ Who? ________________ (relationship)

Hepatocellular carcinoma: Yes/No: ____ Who? ______________ (relationship)

5. DIAGNOSTIC CONFIRMATION

ELISA

1st result:___/___/___ – 2nd result:___/___/___ – 3rd result:___/____/__

Reagent confirmed (anti-HCV): Yes/No: _____ Why? ___________________

PCR

Qualitative: Yes/No: _____ Quantitative: Yes/No: _____

Genotype: Yes/No: ___ Which? _____

Biopsy: Yes/No: _____ Result: _______________________________________

6. DESCRIPTION OF THE ILLNESS

Isolation of the virus: Where? ______________________________________

Blood donor: Yes/No: _____ Where? __________________________________

For how long: _________ How many times: _________

7. OTHER OBSERVATIONS: ____

____

____

Free and Informed Consent Term: Yes/No: _____

Date: ____________________ Signature: _____________________