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Prevalence and epidemiology of chronic hepatitis C among prisoners of Mato Grosso do Sul State, Brazil

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Abstract: In Mato Grosso do Sul state, Brazil, the number of prisoners has increased in the recent years and the control of hepatitis C virus (HCV) has become more complex. The aim of the present study was to estimate the prevalence and identify the genotypes of HCV in prisoners as well as the factors associated with this infectious disease. Thereby, 443 men and 243 women from prisons were interviewed and subjected to blood collection. Anti-HCV reactive samples were analyzed by RT-PCR and genotyped. The overall seroprevalence of HCV infection was 4.8% (95%CI: 3.4 to 6.8%). Furthermore, the prevalence was higher in: men, injecting drug users, tattooed persons, those who were more than 50 years old, individuals who have been arrested multiple times, people with previous history of sexually transmitted disease (STD), persons who received blood transfusions or those with HIV/AIDS. The prevalence of RNA HCV by PCR was 3.0% (95%CI: 1.7 to 4.2%). Moreover, the coinfection of HIV and HCV was 33.3%. In addition, genotype 1 was the most frequent (85%) followed by genotype 3 (15%). The screening strategy for HCV and other infectious diseases in inmates is important as it establishes an early diagnosis, opportunity for treatment and allows the breaking of the transmission chain.

Key words: hepatitis C, genotype, polymerase chain reaction, epidemiology, prisoners.

INTRODUCTION

Hepatitis C virus (HCV) is responsible for the infection of approximately 170 million people worldwide. Incarcerated individuals are particularly affected since they are at higher risk of being infected due to tattooing, piercing and use of injecting drugs (1-8). The living conditions of these people outside and inside prisons contribute to the transmission of infectious diseases. Their lifestyles, combined with worsened drug abuse inside prisons, reflect precarious levels of health care compared to the general population (3, 4).

The seroprevalence of hepatitis C among inmates varies according to local characteristics. A review of previously published international studies has shown a range between 1.5-47.9% (9-13). Previous Brazilian studies have demonstrated values from 6.3 to 41% (14-19).

HCV is classified into six genotypes and multiple subtypes. This variability has epidemiologic importance and is directly related to diagnosis as well as therapeutic response (20, 21).

Genotypes 1, 2 and 3 are more prevalent in Europe, Japan and the United States. Genotype 4 is common in Central Africa, Egypt and Middle East whereas genotype 5 is frequent in South Africa. Lastly, genotype 6 is found in Asia (21-23). In Brazil, genotypes 1, 2 and 3 have been identified (being the first more frequent), and presenting distinct distributions throughout the country (24-31).

The aim of the current study was to estimate the prevalence of HCV as well as to identify the

factors associated with the infection among prison inmates, therefore determining the circulating genotypes of HCV.

PATIENTS AND METHODS

In 2009, from a total of 3,418 men and 395 women, a non-probability sample of 686 prisoners was obtained by using an estimated prevalence of 9.6% (± 2.6) for men and 3.6% (± 2.2) for women. It was difficult to have access to all prison pavilions and cells due to security reasons. The total sample size included 443 men and 243 women, with a significance level of 5%. All individuals were interviewed and their blood samples were collected. The samples were tested by enzyme linked immunosorbent assay (ELISA) and by the immunodot method (rapid test), for the detection of an anti-HCV marker (Bioelisa HCV 4.0®, BioKit, Spain and ImmunoComb II HCV® kit, Orgenics, Germany) and anti-HIV (ELISA and Western blot).

Weakly reactive samples to anti-HCV (OD/cut-off < 3.0) were tested again by line immunoassay (INNO-LIA® HCV Ab III, Innogenetics, Belgium) and anti-HCV positive ones were tested for viral RNA detection by reverse transcription-polymerase chain reaction (RT-PCR) with primers complementary to the conserved area of the 5' NC region of HCV, essentially as previously described (32). Positive samples were also submitted to genotyping method by line probe assay (INNO-LiPA®, Innogenetics, Belgium) using biotinylated primers complementary to the 5' NC region of HCV genome. To confirm HCV genotypes and subtypes, positive samples were amplified with primers complementary to the region NS5B of HCV under the same conditions as described by Sandres-Sauné *et al.* (33). Chi-square, chi-square for trend and Fisher's exact tests were employed for statistical analyses and the prevalence ratios were calculated, with a 95% confidence interval. In order to estimate adjusted prevalence ratios, the Cox regression was chosen (time interval equal to one unit), and variables of significance less than 5% were selected. The present study was approved by the Research Ethics Committee of Federal University of Mato Grosso do Sul.

RESULTS

The overall seroprevalence of HCV infection was 4.8% (95%CI: 3.4-6.8%). Regarding gender, the prevalence was 0.8% in women (95%CI: 0.1-2.9%) and 7% in men (95%CI: 4.9-9.9%).

HCV was more prevalent in men, injecting drug users, tattooed individuals or people who had been subjected to blood transfusion as well as individuals coinfected with HIV. Higher prevalence in persons aged 50 years or more, inmates with multiple arrests and with history of sexually transmitted diseases (STDs was significant in the bivariate analysis (Tables 1, 2 and 3).

Only 23 prisoners reported having undergone acupuncture and all of them were anti-HCV negative. History of hemodialysis was reported by two prisoners, none with hepatitis C. Piercing was reported by only two individuals in the anti-HCV positive group.

Among 33 anti-HCV reactive blood samples, 29 were referred for detection of HCV RNA. Through the use of RT-PCR, HCV was detected in 20 blood samples (69%) therefore the real prevalence of chronic hepatitis in the study sample (n = 686) was 3.0% (95%CI: 1.7-4.2%), being 4.3% in men (95%CI: 2.4-6.2%) and 0.5% in women (95%CI: 0.2-0.7%). Genotype 1 was the most prevalent (85%) followed by genotype 3 (15%). Patients with HIV and HCV co-infection showed the following genotypes: 1a (4/8), 1b (3/8) and 1 (1/8) (Figure 1).

DISCUSSION

This investigation is the first study on the epidemiology of HCV infection in Campo Grande, Mato Grosso do Sul State, and has important public health implications. The prevalence of HCV found among prisoners was higher than that observed in the general population (1.42-1.5%) (34, 35).

The HCV seroprevalence of 4.8% (95%CI: 3.4-6.8%) was lower than those previously found in incarcerated populations in São Paulo city (34-41%) (7, 16). Nevertheless, the present findings are similar to results obtained in prisoners in the municipality of Manhuaçú, Minas Gerais state (6%), Ribeirão Preto, São Paulo state (8.7%), and Salvador, Bahia state (6.4%) (15, 18, 19). In the female incarcerated population of Campo Grande the rate was lower than that found in the Butantã Prison, São Paulo state (16.2%) (17).

When compared with international studies, the prevalence of HCV infection among inmates

Table 1. Distribution of data from prisoners according to factors associated with HCV infection in Campo Grande, Mato Grosso do Sul, Brazil in 2010 (n = 686)

Variables	Anti-HCV + (n = 33)		Anti-HCV – (n = 653)		PR (95%CI)	*p*
	n	%	n	%		
Gender						
Male	31	7.0	412	93.0	1	[1] < 0.001
Female	2	0.8	241	99.2	8.50 (2.05-35.22)	
Age						
Above 50 years	6	10.5	51	89.5	1	[2] < 0.001
31 to 50 years	24	7.2	311	92.8	1.47 (0.63-3.44)	
Under 31 years	3	1.0	291	99.0	10.32 (2.66-40.06)	
Education						
Illiteracy	1	3.8	25	96.2	1	[2] 0.112
Eight years	28	5.8	451	94.2	0.66 (0.09-4.65)	
Above eight years	4	2.2	177	97.8	0.20 (0.20-14.98)	
HCV knowledge						
None	18	4.7	404	95.3	1	[1] 0.399
Yes	15	5.7	249	94.3	0.75 (0.39-1.46)	
Number of arrests						
Six or more	5	14.7	29	85.3	1	[2] <0.001
Two to five	24	6.8	330	93.2	2.17 (0.88-5.32)	
Once	4	1.3	294	98.7	10.96 (3.09-38.86)	
Stable relationship						
No	19	5.4	332	94.6	1	[1] 0.450
Yes	14	4.2	321	95.8	1.30 (0.66-2.54)	
Homosexual relationship						
Yes	6	5.1	112	94.9	1	[1] 0.788
No	25	4.5	529	95.5	1.13 (0.47-2.69)	
No information	2	14.3	12	85.7		
Condom use						
Never	9	4.8	179	95.2	1	[2] 0.458
Sometimes	15	4.2	344	95.8	1.15 (0.51-2.57)	
Always	9	6.9	121	93.1	0.69 (0.28-1.69)	
No information		–	9	100.0	–	
STD						
Yes	21	9.9	192	90.1	1	[1] <0.001
No	12	2.6	450	97.4	3.80 (1.90-7.57)	
No information		–	11	100.0	–	

PR: prevalence ratio; if $p \leq 0.05$, there is significant statistical difference between values; blank information was excluded; [1] chi-square test; [2] chi-square for trend test.

Table 2. Distribution of data from prisoners according to other factors associated with HCV, Campo Grande, Mato Grosso do Sul, Brazil in 2010 (n = 686)

Variables	Anti-HCV + (n = 33)		Anti-HCV – (n= 653)		PR (95%CI)	p
	n	%	n	%		
Injecting drug use						
Yes	18	24.7	55	75.3	1	[2] < 0.001
No	15	2.6	562	97.4	9.48 (5.00-18.00)	
No information		–	36	100.0	–	
Blood transfusion						
Yes	12	10.5	102	89.5	1	[1] 0.001
No	20	3.5	545	96.5	2.97 (1.50-5.91)	
No information	1	14.3	6	85.7	–	
Tattoos						
Yes	25	6.3	372	93.7	1	[1] 0.033
No	8	2.8	281	97.2	2.27 (1.04-4.97)	
HIV/AIDS						
Yes	11	32.4	23	67.6	1	[2] < 0.001
No	22	3.4	630	96.6	9.59 (5.07-18.12)	

PR: prevalence ratio; if $p \leq 0.05$, there is significant statistical difference between values; blank information was excluded; [1] chi-square test; [2] Fisher´s exact test.

Table 3. Variables analyzed by multivariate analysis on the prevalence of HCV among inmates in Campo Grande, Mato Grosso do Sul, Brazil in 2010

Variables	p	Prevalence ratio (PR)	95%CI (PR)
Age	0.828	1.14	0.33- 3.92
History of STD	0.595	1.49	0.34- 6.49
Number of arrests	0.250	1.68	0.70- 4.04
Tattoos	0.019	3.46	2.80- 7.24
Blood transfusion	0.003	3.59	1.54- 8.38
Gender	< 0.001	7.28	1.60- 33.16
Injecting drug use	< 0.001	10.41	4.98- 19.15
HIV/AIDS	< 0.001	10.86	5.04- 19.55

Cox regression: if $p \leq 0.05$, then there is significant statistical difference between variables categories.

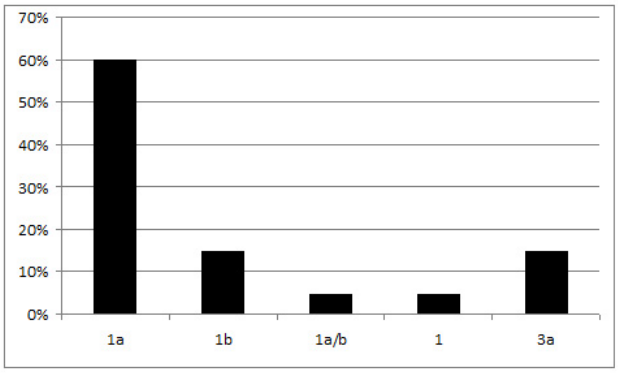

Figure 1. Distribution of blood samples obtained from prisoners according to HCV genotypes in Campo Grande, Mato Grosso do Sul state, Brazil, 2010 (n = 20).

in Campo Grande was lower than those found in northwestern Spain (47.9%), Italy (38%), Canada (26.1%), United States (23.1%), and Ghana (18.7%) (9, 11, 36-38). On the other hand, it was similar to values found in Iran (8.1%), France (4.9%), and higher than in Venezuela (1.5%) (10, 13, 39).

The higher prevalence among men in Brazil differs from data from Canada, where women had a greater exposure to injecting drugs (37). In the female incarcerated population of Campo Grande, the prevalence of HCV infection is lower than in Butantã Prison in São Paulo (16.2%) (17). A study carried out in the Central-West region of Brazil found a prevalence of 6.9% for anti-HCV (95%CI: 5.2-9.2%) among drug users, which is similar to the present findings (40). The frequent use of injecting drugs by women was also observed in Thailand (41).

Low education level, lack of knowledge about hepatitis C, multiple arrests and long periods in prison have been identified by other studies as factors associated with higher occurrences of the infection (9-11, 16, 17, 40). The current study found that less than half of the studied population had steady partners, few individuals used condoms on a regular basis and approximately 1/5 of the studied subjects had a history of homosexual relationship. Although hepatitis C presents low sexual transmission rate, all these factors are connected with high exposure to other STDs (9-11, 16, 19, 39).

The prevalence of HCV was significantly higher among individuals who received blood transfusions and derivates as described in Venezuela in a period prior to 1994 (13). Tattooing was significantly higher in anti-HCV positive groups, which agrees with previous research (10, 11, 18). Despite these other factors, the highest prevalence of hepatitis C in prisons is related to injecting drug use, which was clear in both the bivariate and multivariate analyses, as described in other studies (7, 13, 16, 18, 36-39). The prevalence of anti-HCV was higher among older individuals, which was most probably due to risky behaviors throughout life, a fact observed in Campo Grande and in other incarcerated populations and groups of injecting drug users (11, 37, 40). The use of injecting drugs and tattooing was not significantly higher among blood donors with hepatitis C, probably due to the peculiarities of this population (42).

In the present study, from a total of 29 subjects who underwent testing for HCV RNA, 20 were positive, showing a viremia of 69%, which was lower than values found in injecting drug users in the Central-West region of Brazil (85.4%) and in individuals from Belo Horizonte, Minas Gerais state (98.6%) (40, 43). Such finding agrees with the rate of viremia found in the Northeast region of the country (65.4%) (30).

Genotypes 1 and 3 are more prevalent in Brazil (24-31, 40, 43). The high frequency of genotype 1 and its subtypes was reported among injecting drug users, blood donors, hemophilic persons and patients subjected to hemodialisys (26, 40, 43). In the current work, the subtype 1a was more common, similarly to other studies in the Central-West region, which differs from studies with equivalent subtypes 1a and 1b or predominance of 1b (27, 29- 31, 40, 43). The finding of mixed genotype 1a/b (5%) has been described and may indicate a re-infection by different genotypes (27, 30, 43).

The rate of co-infection of HIV and HCV was high (33.3%) and can be attributed to common factors associated with the risks of these types of infections, such as injecting drug behavior and tattooing (36, 37). Among co-infected patients, only HCV genotype 1 was isolated in the present study, which differs from another work that reported the association of genotype 3 with co-infection and injecting drug users (44).

Finally, the current findings demonstrate that early diagnosis, prevention programs and therapeutic interventions are necessary in order to minimize risks involved in the epidemic spread of HCV inside prison systems.

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CONFLICTS OF INTEREST
There is no conflict.

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ETHICS COMMITTEE APPROVAL
The present study was approved by the Research Ethics Committee of Federal University of Mato Grosso do Sul (CEP/UFMS) under the protocol number 1461/09. Moreover, all subjects included in the present research signed an informed consent form.

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