

*Original Article***Hepatitis C seroprevalence among intravenous drug users in Tehran**

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Abstract

BACKGROUND: Hepatitis C (HCV) is increasing worldwide including Iran. HCV is more prevalent among intravenous drug abusers (IDU), especially if imprisoned, mostly due to needle sharing. We determined the rate of HCV seropositivity among IDU prisoners and compared it with those of non-prisoners.

METHODS: A cross-sectional study was conducted on consenting IDUs inhabiting two prisons and attending three rehabilitation centers in Tehran, Iran. A questionnaire was completed for each subject and 5 ml blood was drawn. The samples were kept at 2-8°C until the sera were separated and stored at -70°C. HCVAb (ELISA) was checked by a single technician. Chi-square, Fisher's exact test and multivariate analysis were used where appropriate.

RESULTS: Five-hundred and eighteen subjects were enrolled. About 74.5% were prisoners and 89.6% were male. Overall, 59.5% were positive for HCVAb (93.2% males and 6.8% females, $P < 0.02$). HCV seropositivity was higher among prisoners compared to non-prisoners (78.3% vs. 30.6%, respectively, $P < 0.001$). Also, it was higher in IDU older than 45 year-old compared to those younger than 30 year-old (77.8% vs. 54.2%, respectively, $P = 0.002$). Multivariate analysis showed significant association of HCV seropositivity with imprisonment (OR: 9.32, 95% CI: 5.60-15.51), sharing syringes (OR: 2.00, 95% CI: 1.26-3.17) and duration of intravenous drug use (OR: 0.86, 95% CI: 0.80-0.92).

CONCLUSIONS: HCV is rather common among IDU prisoners. Imprisonment is an independent risk factor for HCV and the infected IDUs going back to the society could be an important source of HCV. Taking effective strategies (education of high risk groups, provision of sterile syringes, identification and treatment of infected IDUs) to reduce the risk of this public health problem is needed urgently.

KEYWORDS: Hepatitis C, intravenous drug abuse, prison.

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Hepatitis C (HCV) is a growing public health problem worldwide. About 3% of the world's population has been exposed to this virus; most of whom are chronic carriers and at risk of developing complications namely end stage liver disease and hepatocellular carcinoma.¹ Hepatitis C is the most important cause of chronic hepatitis and liver transplantation in Europe and the US.² The same increase has been seen in Iran (unpublished data).

HCV is transmitted by various routes including blood transfusion (especially before

1992),^{3,4} tattooing,⁵ needle stick injury,⁶ and sharing injection equipment.⁷ Among hepatitis C risk factors, intravenous drug use is the most important one,⁷⁻¹¹ the risk of which is further increased by the use of common injecting equipment by IV drug abusers (IDU). Sexual transmission of the virus has also been reported but is not considered a major route.⁷

Hepatitis A, B, and C are considered among desmotic infections, meaning that their prevalence is higher in prisoners than in non-prisoners.¹² As mentioned above, IDUs are at higher risk of blood borne infections due to

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high frequency of needle sharing and promiscuous sexual behavior.¹³ The risk of HCV infection increases rapidly with each injection, as is manifested by increasing HCV seroprevalence with increased duration of intravenous drug abuse (50% to 80% after one year and 100% after eight years).¹⁴ The use of common injecting equipment by IDUs is a main route of HCV transmission.⁹⁻¹⁶

A decade ago, HCV used to be a rarity in Iran with only 0.3% of healthy blood donors being seropositive. Although HCV was the third most common cause of cirrhosis in this country but it lagged far behind hepatitis B in number. This rate was much lower than that reported for western and some regional countries like Egypt (19% to 60% according to age)³ However, it seems that the prevalence of HCV infection is rising in Iran over the last 10 years and the reason is not fully understood. In Iran, addiction traditionally used to be smoking or eating opium or its burnt products. Older data implied that 2% of the Iranian population was addicted in 1970, less than 5% of whom being IDU. Although very accurate data are not available, it is estimated that in 1990 about 3% of the population were addicted, 10-25% of whom were IDU (recognizing that the population has doubled in the same interval).¹⁷ In a study conducted in 1995 in Tehran, 45.3% of IDU prison inmates were HCVAb-positive.¹⁸ However, females were not included in the study and results were not compared with the prevalence of this infection in non-prisoner IDUs. Given the high rate of HCV infection among prisoners (considering that a large proportion of prisoners are drug addicts) and the change in the incidence and pattern of drug abuse in Iran, we decided to determine the prevalence of HCV infection among the high risk prisoners and compare it with those of non-prisoner IDUs.

Methods

This cross-sectional study was carried out between August 2001 and February 2002. The authorities of Evin and Ghezel Hesar penitentiaries and the three active drug rehabilitation

centers in Tehran (Iran) were informed about the high rates of HCV infection among prisoners and IDUs and the potential risks and complications of this disease. In this study, an IV drug abuser was defined as a person using any kind of injectable drug (heroin, cocaine, opium, other) regularly for at least one year.

Prison inmates were selected by random sampling and IDUs referred to the three reference drug treatment centers in Tehran were enrolled sequentially as they referred. The investigators met groups of 20-40 prisoners and the purpose and the nature of the study were fully explained. They were made aware of the consequences of HCV infection and instructed that the participation was voluntary and reassured that the study information would remain confidential. Prisoners were also approached individually, if needed.

After obtaining written informed consent from each subject, a questionnaire was completed to assess the probable risk factors involved in HCV infection. It covered questions related to demography, socioeconomic status, marital status, level of education, occupation, pattern and type of intravenous drug used, duration of intravenous drug use, use of shared injecting equipment, sexual behavior, traditional cupping (hejamat), dental procedures, surgical operations, blood transfusion, ear piercing and tattooing.

After completing the questionnaire, 5 ml blood was drawn from each subject and transferred into a sterile disposable Falcon tube. The blood samples were transported to the laboratory of the Digestive Disease Research Center in Shariati Hospital (Tehran) within 2-5 hours at 2-8°C. They were then centrifuged and the sera were separated and transferred to the sterile tubes having the corresponding codes. The tubes were then stored at -70°C until the time of laboratory processing, which was done once the specimen collection was completed. HCVAb was detected using ELISA third generation (DIA.PRO, Italy) with a sensitivity and specificity of 98%. The tests were performed by one laboratory technician. Data were analyzed using SPSS software, version 10. Chi-square

and Fisher's exact tests were used for bivariate analysis and logistic regression was used for multivariate analysis.

Results

All prisoners who attended the meetings and all subjects who attended the drug abuse treatment centers agreed to participate in the study. A total of 518 subjects, 386 (74.5%) prisoners and 132 (25.5%) non-prisoners were enrolled [464 (89.6%) males, 54 (10.4%) females]. Out of 518 IDUs tested for HCVAb, 51 had equivocal results. Out of 467 subjects with an unequivocal test results, 308 (65.9%) were positive for HCVAb. If the equivocal tests were also considered positive (which is a reasonable assumption in the IDUs as a high risk group), the overall prevalence of HCV seropositivity would be 69.3%.

Imprisonment

Overall, the prevalence of HCVAb seropositivity in our study was 78.3% among prisoners and 30.6% among non-prisoners ($P < 0.001$, OR: 9.32, 95%CI: 5.60-15.51).

Age

The mean age of the IDUs was 36.0 ± 8.2 years (range: 16-63 years) for prisoners and 33 ± 8.66 years (range: 19-54 years) for non-prisoners. The prevalence of HCV infection was higher among older (> 45 years) vs. younger IDUs (15-29 years); i.e. 77.8% vs. 54.2%, respectively (figure 1) with a gradual rise seen with advancing age ($P = 0.002$).

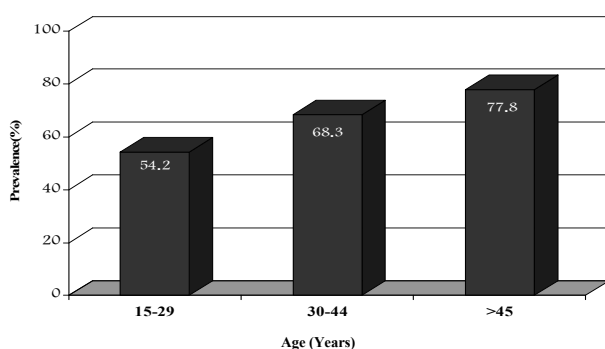


Figure 1. Prevalence of HCVAb in IDU according to Age

Gender

HCVAb was positive in 287 males (61.9%) and 21 females (38.8%) ($P < 0.02$). Among the prison inmates, the prevalence of HCVAb was higher in males (251, 74.7%) than in females (20, 40.0%) ($P < 0.001$). Among the non-prisoners, 36 (28.1%) males and one of the four female subjects were seropositive for HCVAb.

Sexual behavior (table 1)

Overall, 165 (66.3%) subjects with heterosexual promiscuity were HCV positive. However, 65% of those without such behavior were also found to be HCVAb positive, indicating that heterosexual promiscuity is not a risk factor for HCV positivity among this high-risk group ($P = 0.87$). Bisexuality was not correlated with HCVAb seropositivity ($P = 0.52$) but, homosexuality was ($P = 0.04$); i.e. homosexual IDUs were more likely to contract hepatitis C.

Type of drug

Heroin was the most commonly used IV drug both among prisoners and non-prisoners followed by a combination of heroin and opium. Cocaine and morphine were the least used drugs. HCVAb seropositivity was most common among heroin abusers compared to other drugs.

Frequency of injecting

The mean frequency of injecting in prisoners and non-prisoners was 4 times a day (range: 1-20 times) and 3 times a day (range: 1-15 times), respectively. Most of the prisoners (95.5%) and non-prisoners (93.4%) injected between 1 to 6 times a day. Among the HCVAb-positive and HCVAb-negative subjects, 60.1% and 67.5%, respectively, injected between 1 and 3 times a day, indicating a similar distribution in both groups.

Duration of injecting

The mean duration of injecting was 4.7 ± 4.5 years (range: 1-34 years) in prisoners and 3.6 ± 4.2 years (range: 1-22 years) in non-prisoners. Among the HCVAb-positive individuals, the mean duration of injecting was 5.3 ± 4.8 years

Table 1. Prevalence of HCV infection according to sexual behavior.

Sexual Behavior			HCVAb		Total No (%)
			Positive Number (%)	Negative Number (%)	
Heterosexual	Yes	Prisoner	136 (81.9)	30 (18.1)	166 (100)
		Non-prisoner	29 (34.9)	54 (65.1)	83 (100)
	No	Prisoner	135 (74.6)	46 (25.4)	181 (100)
		Non-prisoner	8 (21.1)	30 (78.9)	38 (100)
Homosexual	Yes	Prisoner	19 (79.2)	5 (20.8)	24 (100)
		Non-prisoner	5 (22.7)	17 (77.3)	22 (100)
	No	Prisoner	252 (78.0)	71 (22)	323 (100)
		Non-prisoner	32 (32.3)	67 (67.7)	99 (100)
Bisexual	Yes	Prisoner	16 (80)	4 (20)	20 (100)
		Non-prisoner	6 (27.3)	16 (72.7)	22 (100)
	No	Prisoner	255 (78)	72 (22)	327 (100)
		Non-prisoner	31 (31.3)	68 (68.7)	99 (100)

(range: 1-34 years), while this was 2.9 ± 3.4 years (range: 1-18 years) for the HCVAb-negative individuals ($P < 0.001$). This may again point out that imprisonment is not the sole risk factor of HCV.

Common injecting equipment

Prisoners reported sharing syringes more than non-prisoners (66.5% vs. 49.6 %, respectively, $P < 0.001$). HCV seropositivity was more frequent among those who shared needles (OR: 2.20, 95% CI 1.30-3.71, $P < 0.001$), thus confirming that shared syringes are one of the most

important means of HCV transmission. Overall, the prevalence of HCV infection in IDUs who shared and who did not share syringes was 74.5% and 52.0%, respectively ($P < 0.001$). In addition, 83.0% of prisoners and 41.7% of non-prisoners who shared injecting equipment were HCVAb-positive (table2).

Other risk factors

As seen in table 3, we did not find any significant statistical relationship between HCV infection and other probable risk factors associated with HCV infection.

Table 2. Sociodemographic characteristics and risk factors associated with HCV infection among IDUs in Tehran.

Variables	Prisoner/Non-Prisoner	HCV infection		P-Value
		Positive	Negative	
Imprisonment	Prisoner	78.1%	21.9%	$P < 0.001$
	Non-prisoner	30.6%	69.4%	
Gender (male)	Prisoner	81.8%	18.2%	$P < 0.014$
	Non-prisoner	30.5%	69.5%	
Frequency of injecting per day	Prisoner	3.6%	3.3%	0.1
	Non-prisoner	3.7%	2.9%	0.08
Sharing equipment	Prisoner	82.7%	17.3%	$P < 0.004$
	Non-prisoner	41.7%	58.3%	$P < 0.009$
Mean age (years)	Prisoner	36.06 ± 8.2	32.1 ± 8.3	0.015
	Non-prisoner	33 ± 8.6	32.1 ± 3.8	0.014
Mean duration of injection (years)	Prisoner	5.1 ± 4.7	3.3 ± 3.8	0.001
	Non-prisoner	6.1 ± 5.4	2.6 ± 0.9	0.001

Multivariate analysis

Multivariate analysis showed significant statistical associations of HCV seropositivity with the following three variables: duration of injecting (OR: 0.86, 95% CI 0.80-0.92, the shorter the duration of IV drug abuse, the less likely the IDUs to be HCVAb positive), the use of common syringes (OR: 2.00, 95% CI 1.26-3.17), and imprisonment (OR: 9.32, 95% CI: 5.60-15.51).

Discussion

The relationship between HCV infection and

IV drug abuse has been studied by various investigators. A study conducted on Danish prisoners showed that the incidences of hepatitis B and C were 100 times higher in IDU prisoners than in the general population and 87% of all IDU prisoners were HCVAb-positive,¹⁹ while a similar study in Ireland reported a prevalence rate of 37%.¹⁰ Our data showed that HCV infection is strongly associated with imprisonment among IDUs. In our study, the prevalence of HCV infection was high (78%) in prisoners and they had nine times higher risk of developing HCV infection compared to

Table 3. Risk factors associated with HCV infection.

Risk Factors		HCVAb		Total
		Positive	Negative	
Tattooing	Yes	178 (71.8)	70 (28.2)	248
	No	130 (59.1)	90 (40.9)	220
Blood Transfusion	Yes	35 (60.3)	23 (39.7)	58
	No	273 (66.6)	137 (33.4)	410
Surgery	Yes	124 (66.6)	64 (34)	188
	No	184 (65.7)	96 (34.3)	280
Dental Procedure	Yes	257 (67.1)	126 (32.9)	383
	No	51 (60)	34 (40)	85
Cupping	Yes	64 (58.7)	45 (41.3)	109
	No	244 (68)	115 (32)	359
Ear piercing	Yes	12 (52.2)	11 (47.8)	23
	No	296 (66.5)	149 (33.5)	445
Heterosexual Relationship	Yes	165 (66.3)	84 (33.7)	249
	No	143 (65.3)	76 (34.7)	219
Homosexual Relationship	Yes	24 (52.2)	22 (47.8)	46
	No	284 (67.3)	138 (32.7)	422
Bisexual Relationship	Yes	22 (52.4)	20 (47.6)	42
	No	286 (67.1)	140 (32.9)	426
H/O Jaundice	Yes	54 (65.1)	29 (34.9)	83
	No	254 (66)	131 (34)	385

non-prisoner IDUs. Had we sought the rate of recurrent imprisonment, we may have found different risk ratios, probably higher. Considering a seroprevalence rate of 0.3% for HCV in the Iranian general population, being a prisoner and IV drug abuser is equal to 1181-fold increase in the risk of HCV seropositivity.

HCV infection was more common in males than in females, which is in concordance with most other reports,^{11,20,21} while Butler et al from Australia, found the seroprevalence of HCV

markers to be significantly higher in female IDUs (90%) showing a higher exposure rate in female prisoners than in males.²² Other studies stated that gender does not have much influence on the incidence of HCV infection.¹³ In a study conducted in Iran in 1995, only male prison inmates were enrolled; therefore, the findings cannot be compared.¹⁸

In our study, age was an independent risk factor for HCV seropositivity in both bivariate and multivariate analysis. Although the latter

showed only a marginal effect for age, this may mean that older IDUs may be more susceptible to contract infections like hepatitis C; aside from the effect of age on the duration of IV drug abuse (the older the person, the longer the history of IV drug abuse).

Our finding that the type of sexual behavior was not related to HCV serostatus is in accord with previous reports, which have found no association,^{19,23} indicating that HCV infection in IDUs occurs through other routes such as using common injecting equipment rather than sexual promiscuity.

Heroin was the most common drug of abuse consumed by the prisoners and non-prisoners in our study followed by a combination of heroin and opium. Various drugs are injected at different frequencies to produce the desired effect. Since the chance of HCV transmission is increased with each injection, drugs requiring more frequent injections increase the risk of transmission of bloodborne infections. Heroin is among this group.^{24,25} Since the abuse of injectable drugs other than heroin was very uncommon among our subjects, we can not make any statement on this issue. Interestingly, in our series the higher frequency of injection was not associated with an increased chance of contracting HCV.

Like other studies,^{12,15,26} we found a linear relationship between the duration of injecting and the prevalence of HCV infection. However, some studies stated that the duration of injecting does not have much influence on the rate of HCV infection.^{12,27}

We found a statistically significant relationship between the prevalence of HCV infection and sharing syringes. The effect of sharing needles on increasing the chance of seropositivity of HCV remained significant even after correction for other confounding variables. Although IDUs have a larger pool of HCV infection and may transmit the infection from routes other than sharing needles,^{2,28} the rate of HCV seropositivity has been shown to be higher in those who share syringes, needles and equipment than in those who do not.^{9,11,13,29} In a study carried out in Brazil,

among 102 investigated IDUs, only 5% reported sharing injection equipment, while 64.3% of prisoners had shared needles in the prison during 6 months prior to the study¹¹. However, HCV may be transmitted among IDUs by ways other than simply sharing injecting equipment, such as shared toothbrushes and razors.

Many studies have mentioned that a large number of prisoners start injecting while imprisoned.^{9,30,31}

Using logistic regression analysis, there was a statistically significant association between imprisonment, common syringe usage and age. We did not find any significant association between HCV infection and other probable risk factors, including history of surgical operation, dental procedures, traditional cupping, ear piercing, tattooing or blood transfusion. In a study conducted in Qasr prison (Tehran), 40.1% of male IDUs had a history of tattooing. Also, all IDUs with a history of cupping were HCVAb-positive.¹⁸ In another study carried out in Guilan prison, HCV-positive status was significantly associated with intravenous drug use, having skin tattoos and the number of times being imprisoned. In that study, 45.4% of all prisoners and 88.9% of IDUs were HCV antibody positive.³² A different study found 52% seropositivity of HCV in a community-based setting in Tehran and showed that it was associated with length of drug injection (more than 10 years), length of incarcerations (more than a year) and a history of being tattooed inside prison.³³ Given that the prevalence of drug abuse has increased over the past two decades in Iran,³¹ unpublished data pointed out an increasing prevalence of HCV in the general population. In a study carried out in the central prison of Hamedan, 31.5% of IDUs and 29.1% of non-IDUs had serological evidence of HCV infection.³³

The pattern of drug abuse is also changing (from smoking opium to IV drug abuse, up to 25% have a history of IV drugs injection).¹⁷ There are large national programs to fight against smugglers and IDUs, and the chance of

these people getting confined has probably increased. Our data clearly showed that the chance of contracting hepatitis C increases with being imprisoned. Putting together these pieces of information, it can be hypothesized that the infected IDUs are potential sources of distributing and maintaining HCV infection in general population. Because many cases of these infections go un-noticed and the infected IDUs return to the community without being adequately treated or advised to prevent further contamination of others, they are potent sources of spreading the infection in the society. The high prevalence of HCV infection found in the IDU prison inmates in our study calls for preventive measures to be taken by the authorities of penitentiaries and the Iranian Ministry of Health, setting strategies to reduce the risk of this infection among this high risk

population and prevent its spread to the society through this group. These could include educating prisoners about the hazards of acquiring hepatitis C and that sharing needles and other injection equipment significantly increase the risk of contracting this deadly infection. In addition, the IDU prison inmates can be provided with sterile needles and injection equipment under certain circumstances. HCV infection should be considered a public health priority in Iran and comprehensive prevention programs should be implemented, including education, provision of sterile syringes, identification and treatment of infected IDUs and encouraging addicts to give up drug abuse or switch to the more traditional way of smoking opium, which at least prevents the dual hazard of injection and addiction.

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