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PJBS

ISSN 1028-8880

**Pakistan
Journal of Biological Sciences**

ANSI*net*

Asian Network for Scientific Information
308 Lasani Town, Sargodha Road, Faisalabad - Pakistan

Seroprevalence of Hepatitis C Infection and Associated Risk Factors among Addicted Prisoners in Sari-Iran

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Abstract: The aim of this study was to determine the seroprevalence of hepatitis C infection and associated risk factors among addicted prisoners in Sari-Iran. This is a simple random sampling cross sectional study that was performed on 312 addicted prisoner men at Khazarabad addicts' prison in Sari/Iran in September 2001. Their blood samples were examined through third generation enzyme immunoassay. Data were collected through questionnaires and interview. Associated risk factors were compared in 82 hepatitis C antibody positive addicts (the affected group) and 148 hepatitis C antibody negative addicts (the unaffected group). Out of 312 addicted prisoners, 96 were hepatitis C antibody positive. The seroprevalence of hepatitis C infection was found to be 30.8%. Major associated risk factors in the affected group were as follows: duration of addiction, duration of imprisonment (mean 48 months), route of drug administration, length of alcohol consumption, tattooing, shared usage of needles and razors, multiple sexual partners and type of drugs ($p < 0.05$). On multivariate logistic regression analysis these factors were found to be significant independent risk factors for HCV infection: tattooing (OR 100, 95% CI), multiple sexual partners (OR 4.97, 95% CI) and history of surgery (OR 6.23, 95% CI). It is concluded that hepatitis C infection had a considerable prevalence in addicted prisoners. High risk and unsafe behaviors were found to be the main factors of contamination.

Key words: Addicts, hepatitis C, prisoner, seroprevalence

INTRODUCTION

Incarcerated populations are at high risk for Hepatitis C Virus (HCV) infection, yet prisoners are not routinely screened for HCV infection (Fox *et al.*, 2005). Approximately 1 in 4 of the nearly 2 million individuals in state and federal correctional facilities in the US are infected with hepatitis C virus (Allen *et al.*, 2003a).

Prevalence of HCV infection in prisons is 8 to 20 fold higher than in the community, with infection rates between 16-41% (Allen *et al.*, 2003b). There are 180,000-600,000 drug users in European prisons annually (Birchard, 2001). Correctional facilities are a high risk environment for HCV infection because of a continual high incidence of drug use and high-risk sexual activities (Reindollar, 1999; Birchard, 2003).

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Previous Studies have shown serologic evidence of HCV infection in one of every three prisoners (Shaw-Stiffel, 2000). The prevalence of HCV infection among intravenous drug abusers over the world varies from 50-90% with annual incidence of 10-30% (Hagan and Des-Jarlais, 2000). According to model-based regional estimation in developing countries, it seems that 2.3-4.7 million HCV infections may result from unsafe injections annually (Kane *et al.*, 1999). The risk of HCV transmission is as follows: sexual transmission 5%, but it's up to 20% in homosexuals and prostitutes, in health care workers 5-10%, mother to infant 5% and 1 in 100,000 units of transfused blood (Shaw-Stiffel, 2000; Alavian and Sali, 2000). Other ways of transmission are: tattooing, acupuncture, scarification rituals, circumcision, injection, the shared use of razor blades or tooth brushes, transmission via contaminated tools of dentistry, surgery, hemodialysis, endoscopy and colonoscopy (Sadeghi *et al.*, 1998; Shaw-Stiffel, 2000; Ibrahimi *et al.*, 2001a; Alavian and Sali, 2000; Birchard, 2003). Co-infection of HCV with HIV, HBV and HAV progresses the liver diseases (Mohsen, 2001; Shaw-Stiffel, 2000; De Groot and Bick, 2000; Ibrahimi *et al.*, 2001b). Alcohol intake can worsen the liver damage and improves the hepatitis C virus replication (Mohsen, 2001; Shaw-Stiffel, 2000; Alavian and Sali, 2000; Sadeghi *et al.*, 1998; Degos, 1999).

The laboratory diagnosis of hepatitis C infection is principally based on the detection of HCV antibodies through enzyme immunoassay test (EIA). The sensitivity of the third generation assay is estimated to be 97% and it can detect HCV antibodies within 6-8 weeks of exposure (Alavian and Sali, 2000). There is no vaccine for HCV, because some viral proteins have very high mutability and there is little information on immunity correlation (Sadeghi *et al.*, 1998; Abrignani *et al.*, 1999).

The purpose of this study was to determine the serologic prevalence of HCV infection and risk factors in addicted prisoners. Now in Iran prisoners are routinely screened for HIV infection annually, but there's little information about HCV and HBV in prisons. In addition, in spite of our investigations and based on reviewing articles in Iranian medical journals, there was only one published research about hepatitis C infection in Iran's prisons before September 2001. In Zali *et al.* (1998) study, the seroprevalence of HCV among IDUs was 45%. Considering the various prevalence rate of hepatitis C in the countries and the differences between at risk groups and several ways of transmission, knowing about the prisoners' contamination in the country and the specificity of the morbidity is necessary. The results of

the research will be a useful guide to the serious control of drugs and infectious diseases in correctional facilities.

MATERIALS AND METHODS

This was a cross sectional survey. Three-hundred twelve addicted prisoner men participated in the study by simple random sampling method, at Khazarabad addicts' prison, in Sari/Iran from September 2001 up to September 2003. The study protocol conforms to the provisions of the 1975 Declaration of Helsinki as revised in Edinburgh 2000. Because of security limits of the prison, the close relationship between investigators and prisoners was impossible. So, we trained a volunteer employee and he provided a list of all prisoners' names and selected the samples randomly. Then he informed the samples and encouraged them to cooperate in the research. When some prisoners gave up, the other inmates were selected randomly as mentioned before. Participation in this study was voluntarily and confidentiality was guaranteed. All inmates were informed about the study and they were required to sign the informed consent.

The inmates' blood samples were tested for HCV infection. The data were collected through anonymous questionnaires and interview. The sample size based on the determination of sampling size formula by 95% confidence interval and the least HCV prevalence of 20% in the U.S. prisons (De Groot and Bick, 2000), was estimated 246 people. But because of samples' missing probability and helps of Blood Transfusion Center, the number of samples increased to 312 people. The blood samples were transferred to Blood Transfusion Center at the end of the procedures on that day. The blood samples were examined through the third generation enzyme immunoassay test (EIA-3: sensitivity 100%, specificity 100%, made in Avicenna Medical Center-Russia). The EIA is the cheapest and most accessible test to assay HCV antibodies. Due to false positive cases, it must be followed by Recombinant immunoblot assay test (RIBA) in persons without any risk factors but in high risk groups the positive EIA is enough to refer the cases to specialist. At the same time, the prisoners completed the risk factors questionnaires. If they were illiterate or made some mistakes, two trained prisoners interviewed them to complete the questionnaires. The questionnaire of HCV related risk factors was designed based on valid infectious diseases texts and several previous researches. The scientific validity of the questionnaire was confirmed by some specialists of infectious diseases, biomedical laboratory sciences and other experts. The questionnaire consisted of 50 main questions about individual, familial,

socio-economic history and specially the background of major risk factors of hepatitis C infection. Eighty two questionnaires were omitted from the study because of the prisoners' transfer or their unwillingness to answer. Finally, 230 questionnaires (74%) were collected from the prisoners. The affected group consisted of 82 HCV antibody (HCVab) positive addicted prisoners and the unaffected group consisted of 148 HCVab negative addicted prisoners. There were no significant differences about confounding variables such as age, sex, literacy, employment status, kinds of jobs and monthly income between two groups. The results of EIA test were informed to the samples confidentially in October 2001 and six training classes about prevention of hepatitis C infection were run by researchers for many prisoners and staffs of the prison. In the end, the information and associated risk factors of HCV in the affected and unaffected groups were compared. Descriptive statistics, t-test and χ^2 were used for univariate statistical analysis. Multivariate logistic regression analysis was performed to identify independent Risk factors with 95% confidence interval. The data was analyzed using the Statistical Package for Social Sciences (SPSS) Version 11.5 (Holford, 2002).

RESULTS AND DISCUSSION

There were 96 HCVab positive prisoners among 312 studied populations. So the prevalence of HCV infection was found to be 30.8%. Thirty two of volunteer jailers and personnel were HCVab negative.

The major risk factors of HCV infection in the affected group were as follows: duration of addiction, duration of imprisonment, the type of drug, route of drug administration, tattooing, shared use of needles and razors, multiple sexual partners, alcohol consumption and a history of violence crime. Because a lot of variables

have been investigated, the most important results and associated risk factors of hepatitis C infection have been summarized in Table 1.

On multivariate logistic regression analysis the following factors were found to be significant independent risk factors and the most important predictors of HCV infection: Tattooing (OR 100, 95% CI: 3.5-1000), having multiple sexual partners (OR 4.97, 95% CI: 1.07-23.04), history of surgery (without receipt of blood) (OR 6.23, 95% CI: 1.45-26.64).

The differences between the affected and unaffected groups were not significant about age, receipt of blood and blood products, history of hepatitis diseases in family members, going to traditional and specialized dentists, history of traditional remedies (phlebotomy, applying leeches, etc.), homosexuality, use of condom and injection of hepatitis B and A vaccines (Table 2).

According to Table 1 many established and potential risk Factors for HCV transmission in the affected group were proved. However, on multivariate logistic regression analysis only tattooing, multi-partner sex and history of surgery were found to be significant independent risk factors for HCV infection.

The findings of this study showed that the morbidity risk for HCV infection in tattooed prisoners was at least 3.5 fold higher than non-tattooed prisoners. Tattooing can be one of the main ways of HCV transmission (Ibrahimi *et al.*, 2001a). During a two year Prospective study in Texas-Mexico border on 320 HCV ab positive cases and 307 HCV ab negative controls, many established and potential risk factors for HCV transmission were documented in the patients. But on multivariate analysis only tattooing, injection drug use and blood transfusion were found to be significant independent risk factors for HCV infection (Hand and Vasquez, 2005).

Table 1: The comparison of the major associated risk factors related to HCV infection in addicted prisoners

Risk factors	The affected group (82)	The unaffected group (148)	Total (230)	p-value
Mean duration of addiction (month)	174 (SE±11.8)	96 (SE±6.9)	124 (SE±6.1)	p<0.001
Mean duration of imprisonment (month)	48 (SE±5.9)	23 (SE±2.2)	32 (SE±2.4)	p<0.001
The type of drug				
Heroin	74 (90%)	28 (19%)	102 (44%)	p<0.05
Hashish	53 (64%)	50 (36%)	103 (45%)	p<0.05
Route of drug administration				
Injection	67 (81.7%)	20 (13.5%)	87 (37.8%)	p<0.001
Intranasal	36 (43.9%)	18 (12.2%)	54 (23.5%)	p<0.001
Oral	70 (85.4%)	55 (37.2%)	125 (54.3%)	p<0.001
Tattooing	54 (66%)	37 (25%)	91 (39.5%)	p<0.001
Shared use of syringes	25 (31%)	2 (1.5%)	27 (12%)	p<0.001
Shared use of razors	43 (53%)	29 (20%)	72 (31%)	p<0.001
Multiple sexual partners	61 (74%)	63 (43%)	124 (54%)	p<0.001
Alcohol consumption	49 (60%)	49 (33%)	98 (42.6%)	p<0.001
History of violence crime	25 (31%)	25 (17%)	50 (22%)	p<0.01

Table 2: The comparison of other associated risk factors of hepatitis C infection in addicted prisoners

Risk factors	The affected group (82)	The unaffected group (148)	Total (230)
History of receipt of blood and blood products	10 (12%)	15 (7%)	25 (11%)
History of hepatitis diseases in family members	1 (1.2%)	0	1 (0.4%)
History of going to specialized dentists	70 (85%)	119 (80%)	189 (82%)
History of going to traditional dentists	36 (44%)	78 (53%)	114 (49%)
History of traditional remedies	8 (10%)	13 (9%)	21 (9%)
History of homosexuality	5 (6%)	3 (2%)	8 (3.5%)
History of use of condom in coitus	18 (22%)	23 (16%)	41 (18%)
History of injection of hepatitis B vaccine	5 (6%)	4 (2.7%)	9 (4%)
History of injection of hepatitis A vaccine	2 (2.4%)	1 (0.7%)	3 (1.2%)
The mean age	39.4 (±10.5)	37 (±10.5)	37.9 (±10.5)

In a study on 630 prisoners in correctional facilities in Australia tattooing was an independent risk factor for being HCV positive. HCV positive prisoners were more likely to have injected drugs (Hellard *et al.*, 2004). Results of a study on 973 prisoners in eight Italian prisons showed that HIV and HCV seropositivity were associated strongly with intravenous drug use and tattoos were associated with HCV positivity (Babudieri *et al.*, 2005). During a study on 964 households in San Juan, Puerto Rico, prevalence of HCV infection was 6.3%. Multivariate logistic regression revealed that tattooing, lifetime cocaine and heroine use, blood transfusion and history of imprisonment remained significantly associated with HCV seropositivity (Perez *et al.*, 2005).

In this study the morbidity risk for HCV infection in prisoners with multi sexual partners was 4.97 times higher in the affected group compared with the unaffected group. A considerable number of the affected group (74%) stated that they had multiple sexual partners and the contacts were without using condom most of the time. For heterosexual couples living in a monogamous relationship, studies from the U.S and Europe have demonstrated that the risk of HCV transmission is 5%, although higher rates (7-28%) have been reported from Asia. Prostitutes are more likely to be HCV seropositive, particularly if they have additional risk factors such as a high number of sexual partners, traumatic sexual activity, failure to use a condom, injection drug use and a positive test for syphilis (Shaw-Stiffel, 2000). Among prisoners in the California state correctional system, the risk of HCV infection was significantly elevated in female non- IDUS who reported having sexual partners with a history of IDU (Fox *et al.*, 2005). But during a cross sectional study among 2335 women in Dhaka, Bangladesh it was found that 35% had antibodies to hepatitis B core antigen, 12% had HSV-2 and 0.9% had HCV infection (Bogaerts *et al.*, 2000).

In this study the prevalence of HCV infection was found to be 30.8 and 81.7% of affected prisoners with HCV infection were injection drug abusers (IDUS). In summer 2002 in a descriptive study that was conducted

on 346 addicted male prisoners in central prison in Zanjan city in Iran, the prevalence of infections were as follows: HIV 1.2, HBV 3.8 and HCV 47.6% (Khani and Vakili, 2003). In 2002 in the central prison of Hamedan-Iran during a study carried out on 427 drug abusers, the overall rate of antibody positivity was 0.9 for HIV and 30% for HCV. Of all IDUs, 31.5% and of non-IDUs, 29.1% had serological evidence of HCV infection (Mohammad Alizadeh *et al.*, 2005).

The prevalence of HCV infection among 469 prisoners entering California state correctional facilities was 34.3% overall and was 65.7% among those with a history of injection drug use (IDU) (Fox *et al.*, 2005). In a study which was conducted on 433 inmates in Bologna prison in Italy, 12.5% were HIV positive, 8.1% HBV positive and 31.1% positive. 33.9% of prisoners were IDUS (Sabbatani *et al.*, 2004). According to the study compiled by the European Monitoring Center for Drugs and Drug Addiction, 80% of those injecting in Irish prisons are infected with HCV (Birchard, 2003). The serologic prevalence of HCV infection in a prison in Brazil was 34% (Burattini *et al.*, 2000), in Glasgow prison 72% (Taylor *et al.*, 2000), in Irish prisons 37% (Allwright *et al.*, 2000), in Texas prison 28% and in female prisoners was up to 54% (De Groot and Bick, 2000). During 1996-2001 among 205 subjects were studied at the anti tuberculosis facility in a hospital in Moscow, drug addiction (76%) and hepatitis C and B (77%) were found to be the key concomitant pathologies in them (Batyrov *et al.*, 2003). In the present study, 77% of addicted prisoners were infected with HCV. The prevalence of hepatitis C infection in IDUs has been reported in the U.S. 85-100% (Shaw-Stiffel, 2000), in seven European countries 80% (Touzet *et al.*, 2000) and prevalence in Canada is 90% with annual incidence of 25% (Patrick *et al.*, 2000).

The results of this study showed the alcohol as a major risk factor of HCV infection in the affected group. A high prevalence of HCV infection was noted in patients with alcoholic liver diseases (14-37%). A recent case control study performed in Italy showed that the relative risk of hepatocellular carcinoma in patients with HCV infection and heavy alcohol consumption doubled

(Degos, 1999). Alcoholism can have an accelerating effect on the clinical course of the infection (Allen *et al.*, 2003b). The United Kingdom study showed a strong correlation between high alcohol intake and fibrosis score (Mohsen, 2001). Hepatitis C is the most common indication of liver transplantation in the U.S. (Allen *et al.*, 2003a). More than 30% of liver transplantations now performed in the U.S. are for patients with end-stage liver disease related to chronic HCV. When patients with alcoholic liver disease co infected with HCV are included, the figure is perhaps as high as 45% (Shaw-Stiffel, 2000).

In this study the morbidity risk for HCV infection in the prisoners with a history of surgery was 6.23 fold higher than those without it. In a study in Turkey 151 patients with chronic hepatitis C and 151 control cases were investigated. The results showed that surgical operation, frequent dental therapy, dental extraction, multi-partner sex and blood transmission were the main risk factors for HCV infection in Turkish community (yildirim *et al.*, 2005). Infected Health Care Workers (HCWS) performing invasive exposure-prone procedures, represent a potential risk for patients. In the literature, 14 outbreaks were reported, documenting transmission of HBV from 12 infected HCWS to 107 patients and 2 cases of HCV to 6 patients during cardiothoracic surgery, especially related to sternotomy and its suturing (Puro *et al.*, 2001).

To evaluate the role of digestive endoscopy in transmitting HCV a prospective cohort study was conducted in 3 endoscopic units in north-western Italy. Of 9008 anti HCV negative patients, 92% were retested for anti-HCV 6 months after endoscopy. All of them remained negative, in particular none of patients who underwent endoscopy with the same instrument previously used HVC carriers. The findings showed that properly performed digestive endoscopy is not a major risk factor for the transmission of HCV (Ciancio *et al.*, 2005).

According to the results of the study, it can be concluded that hepatitis C infection had a considerable prevalence in addicted prisoners. High risk and unsafe behaviors like tattooing, having multiple sexual partners, drug misuse and alcohol consumption were the main risk factors of contamination. Most of the infected prisoners will be released and return to the community and their family and they may continue to transmit the infection. We recommend some important strategies to prisons' policy-makers such as routine screening of HCV infection in addicted prisoners, isolation of sever intravenous drug users (IDUs), health education about individual health and the necessity of using clean needles, immunization against hepatitis B, Substance abuse treatment and HCV

treatment (if possible). People especially youngsters should be made aware of hazards of drug misuse and unsafe behaviors. There were some limits in our study. As with any convenience sample, this research may not be a representative of all Iranian prisoners. Because of personal beliefs and security problems, some inmates didn't respond properly to some questions, so we exclude suspicious questionnaires. Because of financial problems, we couldn't perform recombinant immunoblot assay (RIBA) test or Polymerase Chain Reaction (PCR) on our samples. In the experiences of the investigators and views of the prisoners, the training classes by researchers had an important role to increase the knowledge and preventive behaviors of prisoners.

ACKNOWLEDGMENTS

The research project was conducted under the supervision of Research Vice Chancellor of Mazandaran University of Medical sciences with grant number 80-1. Here is appreciated of all officials and colleagues in Blood Transfusion Center, Health and Research Deputies of the University, Prisons' Organization, all of the prisoners and all dear colleagues who helped us during the study.

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