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Seroprevalence of Hepatic Viruses and Associated Risk Factors Among Rehabilitated Patients During the Post-Addictive Phase

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ABSTRACT

Background: Drug addiction poses a major public health risk, particularly in terms of the transmission of blood-borne infections like Hepatitis B (HBV), Hepatitis C (HCV), and Human Immunodeficiency Virus (HIV) among users.

Objective: To assess the seroprevalence of HBV, HCV, and HIV and identify associated risk factors among drug users in rehabilitation centers in Islamabad, Pakistan.

Methods: A cross-sectional study was conducted on 203 drug users from July to October 2022. Participants were screened for HBV, HCV, and HIV using immunochromatographic tests (ICT) and confirmed by Enzyme-Linked Immunosorbent Assay (ELISA). Demographic and risk factor data were collected through structured forms. Statistical analysis was performed using SPSS version 20.0, including descriptive statistics and chi-square tests for associations.

Results: The prevalence rates for HCV, HBV, and HIV were 15.8%, 9.3%, and 3.4%, respectively. Intravenous drug users showed a higher prevalence of HCV (8.4%) compared to non-intravenous users (7.4%). Needle sharing (55.7%) and low socio-economic status (83.2%) were significant risk factors.

Conclusion: HCV is highly prevalent among drug users, especially intravenous users, necessitating targeted harm reduction strategies and enhanced rehabilitation facilities.

INTRODUCTION

Drug dependence remains a significant global health challenge, contributing substantially to the burden of infectious diseases, especially those transmitted through blood-borne routes. According to the World Health Organization (WHO), approximately one in every twenty adults aged between 15-64 years worldwide has used drugs at least once, while 12 million individuals are estimated to use intravenous drugs (1). The prevalence of blood-borne infections such as Hepatitis B virus (HBV), Hepatitis C virus (HCV), and Human Immunodeficiency Virus (HIV) is notably higher among intravenous drug users (IDU) compared to the general population. For instance, IDUs demonstrate prevalence rates of HIV, HBV, and HCV as 14%, 9%, and 52%, respectively (1). This pattern underscores the heightened vulnerability of IDUs to these infections, largely due to risky behaviors such as needle sharing and unsafe injection practices (1-3).

The seroprevalence of these blood-borne viruses is also notably high among non-intravenous drug users, although to a lesser extent compared to their intravenous counterparts (4, 5). In countries where drug use is illegal and the drug market is unregulated, the lack of legal precautionary measures exacerbates the risk of infectious disease transmission. Drug-related activities are often criminalized, which limits the effectiveness of community-based prevention and treatment programs (6). Countries that have adopted a treatment-based rather than punishment-based approach have seen more successful reintegration of drug users into society. Legal frameworks that enforce obligatory treatment and probation for drug users, while penalizing suppliers, have shown promise in curbing the spread of infectious diseases among drug users (7).

In Pakistan, the use of intravenous drugs has been directly linked to the spread of HIV and HCV. The Asian Epidemic Modelling (AEM) in 2015 identified the use of contaminated injection equipment as a major contributor to HIV infection among IDUs, with numbers ranging between 104,804 and 420,000 (APLHIV, 2014). Surveillance data from Pakistan reveals that IDUs account for 15-50% of 150,000 inhabitants in major cities, highlighting the scale of the problem (8). The sharing of needles and drug paraphernalia has been recognized as a principal driver of HCV transmission, which is more prevalent than HIV in many regions (9). The co-infection of HIV and HCV is also of significant concern, with up to 94% of co-prevalence cases reported in some studies, further complicating the clinical management of these patients (10).

The transmission of HBV, HCV, and HIV in drug users is influenced by a complex interplay of economic, political, and environmental factors. These factors often operate at multiple levels, including individual behaviors, societal norms, and healthcare policies (11). In developing countries, the use of highly active antiretroviral therapy (HAART) for HIV has extended life expectancy; however, access to these treatments remains a significant challenge (12). Unlike developed countries, where public health measures have significantly reduced the prevalence of HIV, the rates of HBV and HCV have remained relatively

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unchanged, especially in communities with high levels of IDU (13, 14).

In light of these challenges, there is an urgent need to implement more effective prevention strategies, healthcare provisions, and targeted treatments for HBV, HCV, and HIV among current and former IDUs. These groups remain particularly vulnerable due to their social environments, the types of drugs used, and the dynamics of local drug markets (14). Given the global scale of drug dependence and its associated risks, this study aims to assess the seroprevalence of hepatic viruses among drug users undergoing rehabilitation and to identify associated risk factors. It is crucial to understand these dynamics to develop evidence-based interventions that can mitigate the spread of these life-threatening infections and support the reintegration of drug users into society.

MATERIAL AND METHODS

The study was designed as a cross-sectional descriptive analysis conducted at various rehabilitation centers in collaboration with the COMWAVE Institute (DEC) of Sarhad University, Peshawar, Pakistan. The study aimed to assess the seroprevalence of hepatic viruses (HBV, HCV) and HIV among drug addicts during their post-addiction rehabilitation phase and to identify associated risk factors. The study included both intravenous and non-intravenous drug users admitted to rehabilitation centers. The inclusion criteria were set to encompass all drug addicts, whether intravenous or non-intravenous users, while excluding any individuals who were not drug addicts. The study period extended from July 2022 to October 2022. Approval for the study was obtained from the ethical review board of the respective institutions, and all procedures followed the principles outlined in the Declaration of Helsinki. Informed consent was obtained from all participants after explaining the study's purpose, procedures, potential risks, and benefits.

The demographic, social, and risk factors were investigated using a self-structured case history form, which collected detailed information about age, gender, residence (rural or urban), educational qualifications, occupation, marital status, number of children (if married), siblings, birth order, monthly income, socio-economic status (SES), duration of drug abuse, source and route of drug administration, family history of drug abuse, family history of psychiatric illness, comorbid psychiatric illness, other medical diseases, HIV status, history of blood transfusion, history of legal issues including imprisonment, number of previous treatments, number of relapses, and mode of discharge. This information was collected by trained healthcare professionals and stored securely to maintain confidentiality. A blood sample of 5-7 cc was drawn from each participant under aseptic conditions using gel and clot activator tubes. These samples were transported to the Holy Family Hospital, Islamabad, for serological investigations of HBV, HCV, and HIV. The serum was separated by centrifugation at 5000 rpm for 5 minutes. After separation, the supernatant (serum) was transferred to sterile Eppendorf tubes and stored at -20°C until further analysis.

All collected serum samples were initially screened for HBV and HCV using an immunochromatographic test (ICT) following the manufacturer's instructions (Healgen, Korea). The test procedure involved transferring the patient's serum specimen to a designated well on the test cassette, allowing it to flow laterally along the strip. Results were interpreted based on the appearance of control and test lines, providing either positive or negative results.

Samples that tested positive on ICT were subjected to further confirmation using Enzyme-Linked Immunosorbent Assay (ELISA). For the detection of hepatitis B surface antigen (HBsAg), a quantitative ELISA was performed using the Cell Biolabs Incorporation HBsAg Quantitative ELISA kit, following the manufacturer's protocol. The ELISA procedure involved preparing all reagents at room temperature, adding controls and samples to an anti-HBsAg antibody-coated plate, incubating at 37°C for two hours, and washing to remove excess reagents. Subsequently, monoclonal antibodies conjugated with fluorescein isothiocyanate (FITC) were added, and the plates were incubated and washed again. The HRP conjugate was then added, followed by a substrate solution that produced a color change upon addition of the stop solution. Absorbance was measured at 450 nm using an ELISA plate reader. For HCV confirmation, a first-generation ELISA was performed using kits provided by Biocompare (Lifespan Bioscience Inc.) following the standard protocols for sample preparation, incubation, washing, and absorbance reading.

Similarly, samples that tested positive for HIV were confirmed using a first-generation ELISA kit (Abcam: ab218268 HIV-1 p24 SimpleStep ELISA® Kit). The procedure involved bringing all reagents and specimens to room temperature, adding the appropriate controls, incubating, washing the plates, adding enzyme conjugates and chromogen substrates, and stopping the reaction to measure the color change at 450 nm. The specificity of these assays was maintained by following strict protocols to minimize false-positive and false-negative results.

The data obtained from the study were analyzed using SPSS version 20.0. Descriptive statistics, including frequency, percentages, means, and standard deviations, were used to summarize the demographic characteristics and risk factors of the study population. Cross-tabulation analysis was performed to compare the relationship between the presence of diseases (HIV, HBV, HCV) and the mode of drug use (intravenous vs. non-intravenous). A chi-square test was applied to assess the statistical significance of associations between categorical variables, with a p-value of less than 0.05 considered statistically significant. The findings of this study provide valuable insights into the seroprevalence of hepatic viruses and associated risk factors among drug users, contributing to the development of targeted interventions for this high-risk population.

RESULTS

The results of the study are presented below in a refined and structured format, with improved layout for better readability. The findings are summarized in tabulated formats for demographic characteristics, prevalence of

hepatic viruses (HBV, HCV) and HIV, and associated risk factors among drug users. The study included a total of 203 drug addicts from various rehabilitation centers. The demographic characteristics of the participants are summarized in Table 1. The majority of the participants were male (99%), with a small proportion being female (1%). The participants were divided into five age groups: 18-25 years (14.3%), 26-35 years (34.9%), 36-45 years (27.1%), 46-55 years (11.3%), and above 56 years (12.3%). The highest number of participants were in the 26-35 years age group.

Table 1: Demographic Characteristics of Study Participants (N=203)

Age Group (Years)	Frequency (n)	Percentage (%)
18-25	29	14.3
26-35	71	34.9
36-45	55	27.1
46-55	23	11.3
Above 56	25	12.3

Prevalence of Hepatic Viruses and HIV Among Drug Users

The prevalence of HBV, HCV, and HIV among the study participants was evaluated. Table 2 shows the prevalence of these infections based on the route of drug administration (intravenous vs. non-intravenous). The highest prevalence was observed for HCV (15.8%), followed by HBV (9.3%) and HIV (3.4%). Among intravenous drug users, HCV prevalence was the highest (8.4%), followed by HBV (6.9%) and HIV (2.5%). For non-intravenous drug users, HCV was again the most prevalent (7.4%), followed by HBV (2.5%) and HIV (1%).

Table 2: Prevalence of Hepatic Viruses and HIV Among Drug Users (N=203)

Disease	Status	Total (n)	Intravenous (n, %)	Non-Intravenous (n, %)
Hepatitis B Virus (HBV)	Positive	19 (9.3%)	14 (6.9%)	5 (2.5%)
	Negative	184 (90.7%)	61 (30.1%)	123 (60.6%)
Hepatitis C Virus (HCV)	Positive	32 (15.8%)	17 (8.4%)	15 (7.4%)
	Negative	171 (84.2%)	54 (26.6%)	117 (57.6%)
HIV	Positive	7 (3.4%)	5 (2.5%)	2 (1%)
	Negative	196 (96.6%)	59 (29.1%)	137 (67.5%)

Various risk factors associated with drug usage and the transmission of hepatic viruses and HIV were analyzed. Table 3 presents the detailed analysis of risk factors such as years of drug abuse, types of abused drugs, relapse rate, family history of drug abuse, psychiatric illness, history of blood transfusion, imprisonment, and individual risk factors like tattoos, body piercing, and needle sharing. It was found that most participants had been abusing drugs for 1-5 years (58.6%). White crystal and heroin were the most commonly abused drugs, with relapse rates observed in 83.2% of the participants. A majority had no family history of drug abuse (69.9%), and a significant proportion had a history of imprisonment (35.5%).

Table 3: Risk Factors Associated with Drug Usage Among Study Participants (N=203)

Variable	Category	Frequency (n)	Percentage (%)
Years of Drug Abuse	Less than a year	5	2.5
	1-5 years	119	58.6
	6-10 years	3	1.5
	11-15 years	37	18.2
	16-20 years	23	11.3
	More than 20 years	16	7.9
Previously Abused Drugs	Cannabis	121	59.6
	Alcohol	18	8.9
	Heroin	15	7.4
	Opium	22	10.8
	White Crystal	27	13.3
Currently Abused Drugs	Cannabis	9	4.4
	Heroin	54	26.6
	Opium	11	5.4
	White Crystal	59	29.1
	Marijuana	16	7.9
	Benzodiazepines	11	5.4
	Alcohol	43	21.2
Relapse Rate	Relapse	169	83.2
	No Relapse	34	16.7
Previous Treatment History	Treatment Received	96	47.3

Variable	Category	Frequency (n)	Percentage (%)
	No Treatment	107	52.7
Family History of Drug Abuse	Present	61	30.1
	Absent	142	69.9
Family History of Psychiatric Illness	Present	25	12.3
	Absent	178	87.7
History of Blood Transfusion	Present	24	11.8
	Absent	179	88.1
History of Imprisonment	Yes	72	35.5
	No	131	64.5
Individual Risk Factors	Tattoos	61	30.1
	Body Piercing	29	14.3
	Needle Sharing	113	55.7

The study demonstrated a significant prevalence of HCV (15.8%), HBV (9.3%), and HIV (3.4%) among drug users, particularly those using intravenous routes. The data suggest that sharing of injection equipment is a key factor in the transmission of these infections. Additionally, socio-economic conditions, history of drug abuse in the family, and other individual risk factors such as needle sharing, tattoos, and body piercings were also associated with the transmission of these viruses among drug users. These findings highlight the need for targeted interventions, including harm reduction strategies and more comprehensive rehabilitation facilities, to address these issues effectively.

DISCUSSION

The current study assessed the seroprevalence of Hepatitis B virus (HBV), Hepatitis C virus (HCV), and Human Immunodeficiency Virus (HIV) among drug users in rehabilitation centers and identified associated risk factors. The findings revealed that HCV had the highest prevalence (15.8%) among the study participants, followed by HBV (9.3%) and HIV (3.4%). These results are consistent with previous studies, which have also reported a higher prevalence of HCV among intravenous drug users (IDUs) compared to non-intravenous users (7, 15). The high prevalence of HCV could be attributed to the practice of sharing contaminated needles and syringes, a common behavior among IDUs, which has been identified as a major route of transmission for HCV in various settings (Aggarwal et al., 2003). The findings further indicated that HBV and HIV infections were less prevalent but still significant among this population, aligning with other studies that have highlighted the risk of blood-borne infections in drug users (2, 16).

The study also revealed that a significant proportion of the drug users belonged to a low socio-economic background, which has been shown to be a critical factor contributing to increased vulnerability to infectious diseases, including HBV, HCV, and HIV. Previous research conducted in Pakistan demonstrated that socio-economic deprivation, coupled with risky behaviors such as needle sharing, increases the risk of infection among IDUs (1-3, 17). Moreover, the high relapse rate observed in the study participants (83.2%) underscores the need for more robust rehabilitation and harm reduction programs that focus on both preventing drug relapse and reducing the risk of infectious diseases transmission. The association between frequent relapses and the potential for increased infectious disease spread has been documented in earlier studies (18).

Several risk factors for the transmission of HBV, HCV, and HIV were identified in this study, including a history of blood transfusions, body tattoos, body piercing, and needle sharing. These findings are consistent with other studies that have reported these factors as major contributors to the spread of blood-borne infections among drug users (19). The study also found that 30.1% of participants had a family history of drug abuse, and 12.3% had a family history of psychiatric illness. Previous research has suggested that psychiatric illness and a family history of substance abuse may predispose individuals to drug addiction and increase their risk of blood-borne infections (16).

The strengths of this study include its focus on a high-risk population and the comprehensive data collection that encompassed multiple risk factors and socio-demographic variables. This allowed for a thorough understanding of the context in which these infections are spreading among drug users. However, there were also several limitations. The study's cross-sectional design limited the ability to establish causality between identified risk factors and the seroprevalence of HBV, HCV, and HIV. Additionally, the sample size, while adequate for preliminary analysis, may not be fully representative of all drug users in different geographic regions, limiting the generalizability of the findings. The reliance on self-reported data for some variables, such as history of drug abuse and risk behaviors, may have introduced recall bias or social desirability bias.

Despite these limitations, the study provides valuable insights into the high burden of HBV, HCV, and HIV among drug users, particularly those using intravenous routes. The findings suggest that effective harm reduction strategies, such as needle exchange programs, safer injection practices, and comprehensive education about the risks associated with needle sharing, are urgently needed. These interventions could help reduce the prevalence of blood-borne infections in this vulnerable population. Furthermore, policymakers and public health authorities should consider establishing more rehabilitation centers with integrated services that cater to both addiction treatment and the management of infectious diseases. Segregating patients with contagious diseases from the general rehabilitation population might also be necessary to prevent disease

transmission, especially in crowded facilities where such infections can spread rapidly.

Future studies should focus on longitudinal designs that can provide more robust evidence of causality between drug use behaviors and the transmission of blood-borne infections. It is also recommended that future research explore the effectiveness of different harm reduction and rehabilitation strategies in reducing both drug use and the prevalence of infectious diseases. This will help in formulating evidence-based policies and interventions tailored to the needs of drug users, ultimately contributing to better health outcomes and quality of life for this high-risk group (19).

CONCLUSION

The study concluded that Hepatitis C virus (HCV) is highly prevalent among drug users, particularly those who use intravenous routes, with notable but lower prevalence rates for Hepatitis B virus (HBV) and Human Immunodeficiency Virus (HIV). These findings highlight the critical need for targeted harm reduction strategies, including safer injection practices, needle exchange programs, and comprehensive rehabilitation services that address both addiction and infectious disease management. Implementing such measures can significantly reduce the transmission of blood-borne infections in this vulnerable population, ultimately improving public health outcomes and reducing the healthcare burden associated with drug use-related infectious diseases.

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