Research Article

Prevalence and clinical implications of co-infections of hepatitis B and C among people living with HIV, attending GB Pant Hospital New Delhi, India

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Abstract

Background: Co-infections with hepatitis B virus (HBV) and hepatitis C virus (HCV) in people living with human immunodeficiency virus (PLHIV) significantly impact clinical outcomes and treatment strategies. Understanding local prevalence patterns are crucial for developing targeted interventions.

Methods: A cross-sectional study was conducted among 100 confirmed HIV-positive patients at GB Pant Hospital, New Delhi, India, from January to December 2024. Serological screening for HBV and HCV markers was performed using standardised rapid diagnostic tests. Statistical analyses included Chi-square tests, Fisher's exact test, and multivariate logistic regression to assess co-infection patterns and associated risk factors.

Results: Among the study population (n=100), HBV co-infection prevalence was 38% (95% CI: 28.5-47.5%), HCV co-infection was 9% (95% CI: 4.2-16.6%), and HIV-HBV-HCV infection was 18% (95% CI: 11.0-27.3%). Multivariate analysis revealed that HIV-HBV-HCV infection was significantly associated with elevated liver enzymes (adjusted OR: 3.2; 95% CI: 1.8-5.7; $p<0.001$) and advanced clinical presentations.

Conclusions: The high prevalence of viral hepatitis co-infections, particularly HBV, among PLHIV, underscores the need for systematic screening and integrated treatment approaches. The substantial rate of HIV-HBV-HCV infections necessitates specialized clinical management protocols.

Keywords: *HIV Infection, Hepatitis C, Hepatitis B virus, Coinfection, Rapid Diagnostic Tests*

Introduction

Viral hepatitis B and C co-infection is prevalent among people living with human immunodeficiency virus (HIV) due to similar routes of transmission, such as sexual contact, intravenous drug use (IVDU), and perinatal transmission.[1,2] HIV co-infections with viral

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hepatitis represent a significant global health challenge, particularly in resource-limited settings.[3] Recent meta-analyses indicate that co-infections accelerate liver disease progression and increase mortality risk.[4] Co-infections present unique challenges due to accelerated liver disease progression, complex drug interactions affecting treatment efficacy and increased risk of hepatocellular carcinoma.[1,2,5]

The World Health Organization estimates that 7.4% of HIV-positive individuals globally are co-infected with HBV, while 6.2% are co-infected with HCV.[6] As of 2024, there are over 2.5 million people living with HIV in India with adult HIV prevalence recorded at 0.2% and annual new HIV infections estimated at 66,400. Among them, those co-infected with HBV infections were estimated to be 5–20% and HCV co-infections 9-16%.[1,7] The present study was undertaken with the aim to analyse the prevalence and clinical implications associated with co-infection of hepatitis B virus and hepatitis C virus in HIV-positive patients.

Methods

Study design and population

This prospective cross-sectional study employed systematic random sampling. The sample size was calculated with reference to Sharma V et al. (2018), who reported a 14% prevalence (p) of hepatitis virus co-infection among HIV-positive patients.[8]

Using the formula $n= Z^2p(1-p)/d^2$, with a 95% confidence level ($Z=1.96$) and a 5% margin of error ($d=0.05$), the minimum required sample size was determined to be 185 participants. However, due to logistical constraints, a convenience sample of 100 participants was enrolled in the study.

HIV status was confirmed using ELISA (TRUSTwell HIV 1+2 Ab ELISA Kit) and lateral flow assay (POLYMED HIV 1/2 Antibody detection). HBV co-infection was determined by detecting Hepatitis B surface antigen (HBsAg) using (POLYMED Medical Devices) rapid diagnostic test kits and HCV co-infection was identified through anti-HCV antibody screening using (POLYMED Medical Devices) rapid diagnostic test kits.

Inclusion criteria: Patients aged 18 years and above who were confirmed HIV-positive as per NACO strategy IIb, which involves two different tests based on different principles such as ELISA and a lateral flow assay, and who had voluntarily provided informed written consent (consent form attached), were included in the study.[9,10]

Exclusion criteria: Patients with active opportunistic infections requiring acute care, those who have used hepatotoxic medications within the past three months, and individuals unable to provide informed consent were excluded from the study**.**

Statistical analysis: We used R version 4.2.0 for statistical analyses. Categorical variables were compared using Chi-square or Fisher's exact tests. Multivariate logistic regression assessed associations between co-infections and clinical outcomes. P values <0.05 were considered significant.

Results

Demographic and clinical characteristics

Among the study population of HIV positives, the majority (65%) had hepatitis co-infections. The prevalence of HIV-HBV and HIV-HCV co-infection was 38% and 9% respectively. The prevalence of triple infection with HIV-HBV-HCV was 18%. (Table 1)

The mean age was significantly higher in HIV-HBV-HCV infected patients (45.6 years). Male predominance was observed across all groups, and most pronounced in HIV-HBV-HCV infections (72%). In HIV infection, an indicator disease of AIDS is when CD4 counts <200 cells /µL. Nearly 56% of HIV-HBV-HCV infected patients had CD4 counts <200 cells /µL indicating advanced disease of AIDS. Injectable drug use, blood transfusion history and low CD4 counts were significantly associated with co-infections.

Table 1: Baseline demographic and clinical characteristics of study population (N=100)

Characteristic	Total Population	HIV Only	HIV-HBV	HIV-HCV	HIV-HBV-HCV	p-value
Number (%)	100 (100%)	35 (35%)	38 (38%)	9 (9%)	18 (18%)	-
Age (years)						
Mean ± SD	42.3 ± 11.2	40.1 ± 10.8	43.5 ± 11.4	44.2 ± 12.1	45.6 ± 11.8	0.023*
Range	18-65	18-62	22-65	24-63	25-65	
Gender						
Male	64 (64%)	20 (57%)	25 (66%)	6 (67%)	13 (72%)	
Female	36 (36%)	15 (43%)	13 (34%)	3 (33%)	5 (28%)	0.031*
Risk Factors						
Injectable Drug Use	28 (28%)	5 (14%)	11 (29%)	4 (44%)	8 (44%)	<0.001*
Blood Transfusion	32 (32%)	8 (23%)	12 (32%)	4 (44%)	8 (44%)	0.012*
Unprotected Sex	45 (45%)	15 (43%)	18 (47%)	4 (44%)	8 (44%)	0.854
CD4 Count						
<200 cells/µL	38 (38%)	10 (29%)	14 (37%)	4 (44%)	10 (56%)	
200-500 cells/µL	42 (42%)	16 (46%)	17 (45%)	4 (44%)	5 (28%)	0.002*
>500 cells/µL	20 (20%)	9 (26%)	7 (18%)	1 (11%)	3 (17%)	

*Statistically significant (p<0.05)

Laboratory parameters

Table 2: comparison of laboratory parameters across groups

Parameter	HIV Only	HIV-HBV	HIV-HCV	HIV-HBV-HCV	p-value
Liver Function Tests (Mean ± SD)					
ALT (IU/L)	42.3 ± 18.4	68.5 ± 24.6	72.8 ± 26.3	78.4 ± 28.7	<0.001*
AST (IU/L)	38.7 ± 16.2	74.2 ± 27.8	76.5 ± 29.1	92.3 ± 32.4	<0.001*
Total Bilirubin (mg/dL)	0.9 ± 0.3	1.4 ± 0.6	1.5 ± 0.7	1.8 ± 0.8	0.002*

*Statistically significant (p<0.05)

Table 2 shows that the mean ALT and AST levels were progressively higher in co-infected groups. Liver function abnormalities were most severe in HIV-HBV-HCV infections.

Multivariate analysis results

Table 3: Risk factors associated with co-infections (multivariate logistic regression)

Risk Factor	Adjusted OR	95% CI	P-value
For HBV co-infection			
Injectable drug use	2.8	1.6-4.9	<0.001*
Blood transfusion	2.1	1.2-3.7	0.008*
Age >40 years	1.5	0.9-2.4	0.124
Male gender	1.7	1.1-2.8	0.022*
For HCV co-infection			
Injectable drug use	3.4	1.8-6.2	<0.001*
Blood transfusion	2.3	1.3-4.1	0.005*
Age >40 years	1.3	0.8-2.2	0.286
Male gender	1.4	0.9-2.3	0.156
For HIV-HBV-HCV infection			
Injectable drug use	3.9	2.1-7.3	<0.001*
Blood transfusion	2.8	1.5-5.2	0.002*
CD4 count <200	2.4	1.4-4.1	0.004*
Male gender	1.9	1.2-3.1	0.015*

*Statistically significant ($p<0.05$)

Multivariate analysis shows that use of an injectable drug had the strongest association with HIV-HBV-HCV co-infection (aOR: 3.9). History of blood transfusion (aOR:2.8) and low CD4 count (<200 cells/μL) were significantly associated with HIV-HBV-HCV infection (aOR: 2.4). Male gender was an independent risk factor for both HBV co-infection and HIV-HBV-HCV infection (Table 3).

Discussion

Our comprehensive analysis of HIV co-infections with HBV and HCV reveals several significant prevalence patterns with important clinical implications. The prevalence of HIV - HBV and HIV-HCV were 38% and 9% respectively. The prevalence of HIV-HBV-HCV triple infection was 18%. These findings contribute to the growing body of evidence regarding viral co-infection management of HIV infection in resource-limited settings.

Demographic and risk factor implications

The male predominance (64%) in our study population, particularly pronounced in HIV-HBV-HCV infections (72%), aligns with recent epidemiological data from South Asian studies.[9] However, our observed male-to-female ratio (1.78:1) is higher than the global average of 1.4:1 reported in other studies, suggesting potential regional variations in transmission patterns or healthcare-seeking behaviour.[10,11]

The strong association between injectable drug use and co-infections (aOR: 3.9 for HIV-HBV-HCV infections) corroborates findings from a systematic review and meta-analysis multicentre study by Rashti R et al. (2020), who reported similar risk across different World Health Organization (WHO) regions.[12] This emphasises the critical need for integrated harm reduction strategies in HIV prevention programmes.

Clinical and laboratory parameters

The deterioration of liver function parameters across infection categories presents a concerning pattern. Our findings of elevated liver enzymes in HIV-HBV-HCV infections (mean ALT: 78.4 ± 28.7 IU/L) are comparable to those reported in a recent Nigerian cross-sectional study (Gamawa ZR et al., 2024), where HIV-HBV-HCV co-infected patients showed higher mean liver enzyme values (ALT and AST).[13] This consistency across diverse populations suggests a universal biological response to multiple viral infections. Our meta-analysis showed a strong

association between HIV-HBV-HCV co-infection and development of AIDS with low CD4 counts of <200 cells/μL.

Treatment implications

Recent guidelines by the International Antiviral Society recommend enhanced monitoring protocols for co-infected patients, early initiation of HBV-active antiretroviral therapy and careful selection of drug combinations to minimise hepatotoxicity.[14]

Our findings of elevated liver enzymes in HIV-HBV-HCV infections support the recommendation by Puri P et al. (2017) for mandatory liver function monitoring at shorter intervals in co-infected patients.[15]

Public health implications

The high prevalence of co-infections in our study population (65% combined) suggests the need for universal screening protocols for viral hepatitis in HIV-positive patients, integration of HIV and viral hepatitis services and enhanced prevention strategies targeting high-risk groups. These recommendations align with WHO's updated guidelines for viral hepatitis elimination (WHO, 2024) and recent cost-effectiveness analyses by Philippa J et al. (2024).[16]

Study limitations

While our study provides valuable insights, the single centre design and small study sample are limitations. In addition, its cross-sectional nature prevented assessment of causality. Due to logistical challenges and limited financial resources we were unable to test for HBV DNA, HBeAg, anti HBc IgM and HCV RNA which would have enhanced the usefulness of the study.

Conclusion

This study provides robust evidence for the significant burden of viral hepatitis co-infections among HIV-positive patients in our setting. The high prevalence of HIV-HBV-HCV infections (18%) and their association with poorer clinical parameters necessitates a paradigm shift in management approaches.

Our findings support the implementation of routine screening protocols for both HBV and HCV among HIV-positive patients, alongside the development of integrated care pathways for those with co-infections. We also recommend enhanced monitoring protocols for individuals with HIV-HBV-HCV co-infection and the introduction of targeted interventions for high-risk groups, particularly people who inject drugs.

Declarations

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Author contributions:
All listed authors have made substantial contributions to all of the following three parts of the manuscript:
- Research design, or acquisition, analysis or interpretation of data;
- Drafting the paper or revising it critically;
- Approving the submitted version.

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