Epidemiological features and risk factors for acquiring Hepatitis B, Hepatitis C and syphilis in HIV-infected patients in Shaanxi Province, northwest China

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Abstract

Background HIV-infected patients are at higher risk for co-infection with Hepatitis B virus (HBV), Hepatitis C virus (HCV), and Treponema pallidum (TP), the agent causing syphilis, than the general population. The prevalence of HBV, HCV, and syphilis had geographic differences and varied from region to region among HIV-infected patients. The aim of this study was to investigate the epidemiological features and risk factors of HBV, HCV, and syphilis infection in HIV-infected individuals in Shaanxi Province, northwest China. Methods A retrospective study was conducted with HIV-infected patients from June 2011 to June 2016 in Shaanxi Province. Sociodemographic data was captured from the national HIV/AIDS information system in China. Serological tests and analysis of CD4+ T-cell count levels were performed using standard procedures. Besides, the HIV infection time and age were presumed by CD4+ T-cell count levels. Results The average time from HIV infection to diagnosis was (4.7±2.4) years, and the HIV infection time ≥3 years accounted for 66.8%. Of the discovery routes, voluntary counseling & testing (VCT) only accounted for 20.7%. Among 1018 HIV-infected patients, the prevalence of HBV, HCV, and syphilis was 11.0%, 11.1%, and 26.0%, respectively. HBV-HCV, HCV-syphilis, HBV-syphilis, and HBV-HCV-syphilis co-infection was 1.7%, 2.2%, 2.6%, and 0.1%, respectively. The rate of ineffective vaccination against HBV was as high as 30.2% in HIV-infected patients. Ethnicity (OR=29.257, 95%CI: 11.243-76.133) and HIV transmission routes (OR=149.368, 95%CI: 16.590-1 344.861) were the risk factors of HCV infection in HIV-infected patients. In the HIV-infected patients with the antibody of Treponema pallidum, the rate of homosexual transmission was so higher but heterosexual transmission is lower (OR=0.548 95% CI: 0.382-0.786), suggesting that homosexual transmission might be a risk factor for HIV-syphilis co-infection. Conclusion The HIV-infected patients in Shaanxi Province had the characteristics of low active detection rate and late diagnosis. In addition, a high prevalence of HBV, HCV, and syphilis co-infection could be observed, and like HIV infection, they might not understand their HBV, HCV and syphilis infection status. At last, the high rate of ineffective vaccination against HBV suggests a need for improved vaccination services.

Background

Human immunodeficiency virus (HIV) shares similar routes of transmission with Hepatitis B virus (HBV), Hepatitis C virus (HCV), and *Treponema pallidum* (TP), the agent causing syphilis, such as sexual transmission, blood transfusion, and mother-to-child transmission. Therefore, it is very common that HIV-infected patients co-infected with HBV, HCV, and syphilis. It is estimated that approximately 5% to 20% of HIV-infected patients worldwide are infected with HBV[1], and 15%-30% are simultaneously infected with HCV[2]. Similarly, syphilis has been widely spread among HIV-infected individuals in the last few years, especially in men who have sex with men (MSM)[3, 4]. There is no doubt that the high prevalence of HBV, HCV, and syphilis in HIV-infected patients has become a new global emerging public health concern worldwide [5, 6].

Though single infection with any of these pathogens arouses a significant health concern, the further increasing morbidity and mortality are observed in so many cases of co-infections [7]. Comorbidities

such as chronic liver disease caused by HBV or HCV infection are recognized as significant problems in HIV-infected patients[8]. Evidence suggests that co-infection with HBV or HCV adversely affects the clinical course of HIV infection [9, 10]. HIV-HBV co-infections, especially those with a high HBV DNA load, are associated with lower CD4+ T-cell counts before treatment initiation [11]. Similarly, various studies have reported that poorer immunological response to Antiviral therapy (ART) in HIV-HCV co-infected patients, and co-infection with HCV also increases the morbidity and mortality in HIV-infected patients [12, 13]. Moreover, newly introduced direct-acting agents (DAAs) against HCV have shown severe drug-drug interactions with antiretroviral agents, complicating the treatment of both diseases [14, 15]. Conversely, HIV infection can accelerate the course of hepatitis B and hepatitis C, resulting in a faster progression to fibrosis and cirrhosis[16, 17] and making liver disease one of the most important non-AIDS causes of death of HIV-infected patients in the last few years[18]. In recent years, a resurgence of TP has occurred in China [19]. As an ulcerative infection, syphilis not only increases HIV viral load and decreases CD4+ T-cell counts in HIV-infected patients with new syphilis infections[20], but also increases the risk of sexually transmitted infections (STIs)[21]. In a word, mixed infection not only causes changes in biological behavior between viruses, but also affects each other's natural course, complicates the clinical manifestations of infected individuals, and brings difficulties to clinicians' diagnosis and treatment ultimately[22-24]. It also brings individuals, families and society heavy burden, especially in underdeveloped areas.

In China, HIV-infected patients are usually found late, especially in the elderly [25]. Most of them are discovered by means of passive detection, such as preoperative testing, other patient detection, and STD (sexually transmitted diseases) clinics, etc[26]. Due to common routes of transmission, patients may not understand their infection status of HBV, HCV, and syphilis which may accelerate the progression of HIV severely. Moreover, studies reported that the rates of co-infection with HBV, HCV, and syphilis had geographic differences and varied from region to region, and based on study population and risk factors for virus acquisition[27-29]. In China, studies showed that among HIV-infected individuals, approximately 5.3%-19.4% were positive for HBV[30-34]; as assessed by the hepatitis B surface antigen (HBsAg) test, while HCV positivity (detected by the anti-HCV antibody test) varied from 2.2% to 62.4%[30-35]. However, the epidemiological and clinical profiles of HBV, HCV, and syphilis infection among HIV-infected patients remain unknown in many regions of China. Further, the impact of HBV, HCV, and syphilis on immunologic parameters of HIV-infected persons is poorly characterized. Thus, the aim of this study was to assess the epidemiological features and risk factors of HBV, HCV, and syphilis infection among HIV-infected patients in Shaanxi Province, which is less developed for economics in northwest China, and its correlation with CD4+ T-cells among HIV-infected patients at baseline.

Methods

Study population

After obtaining approval from the local ethics committee, a retrospective study was conducted using blood samples collected from 1018 HIV-positive individuals whose positive status was confirmed by

western blotting (HIV Blot 2.2 WB, MP Biomedicals Asia Pacific Pte. Ltd., Singapore) between June 2011 and June 2016 at Shaanxi Provincial Center for Disease Prevention and Control. All participants in this study were HIV-1 seropositive. The subjects' epidemiological data were gained from the national HIV/AIDS information system in China. Participants were defined as presenting HBV infection if they tested positive for HBsAg. Similarly, anti-HCV antibody positive was defined as a marker for HCV infection, and anti-TP antibody positive was defined as a marker for syphilis infection.

ELISA

Serum samples stored at -80°C were thawed to room temperature (25±2 °C) and used for HBsAg, anti-HBs, HBeAg, anti-HBe, anti-HBc, anti-HCV and anti-TP detection by ELISA (Lizhu Co., China). Limiting antigen avidity enzyme immunoassay (LAg-avidity EIA) (Jinhao Co., China) was employed to detect recent HIV infection. All ELISA was performed according to the manufacturer's instructions. Positive and negative controls were supplied in the kit and the cut-off values for the respective tests were defined according to the manufacturer's instructions.

CD4+ T-Cell Count

The CD4+ T-cell counts were estimated with flow cytometry (BD Trucount Tubes) using the FACSCalibur apparatus (Becton-Dickinson, New Jersey, USA) and the results were expressed in cells/mm^3.

Estimation of HIV infection time and age

The epidemiological data and CD4+ T-cell counts within one year of the report was collected and analyzed. According to the rule that the CD4+ T-cell counts were reduced by 50/μL per year after infection with HIV, the possible infection time and age were presumed[25, 36]. Specific rules were shown in Table 1.

Statistical analysis

The prevalence of HBV, HCV, and syphilis co-infections among HIV-infected individuals was analyzed by descriptive statistics and presented as percentages. Chi-squared and Fisher's exact tests were used to determine the relationship between categorical variables. Multivariate logistic analysis was used to determine risk factors. Odds ratio (OR) with 95% confidence interval and *p*-value were calculated. The comparisons of continuous variables between groups were analyzed by Student's t-test. The level of significance was set at $p<0.05$. All data were analyzed using SPSS 25.0 Software (SPSS Inc., Chicago, IL).

Results

Sociodemographic characteristics of HIV-infected patients

The retrospective analysis of laboratory records identified 1018 individuals with HIV infection from June 2011 to June 2016 at Shaanxi Provincial Center for Disease Control and Prevention, whose average age was 36.0±13.2 years old, ranging from 2 to 83 years old. And their median age was 34.0 years old. The age distribution was mainly concentrated in 20-50 years old, accounting for 80.6%. And ethnicity groups of the 1018 HIV-infected patients included Han Nationality (91.5%), Yi Nationality (7.0%), and others (1.6%). The most patients (46.8%) in this study had married with spouse. More than 64.1% of patients had low literacy (Junior high school level and below). And HIV infection was mainly transmitted through sexual contact (90.7%), including heterosexual transmission (65.5%) and homosexually transmission (25.1%) (Table 2).

CD4+ T-cell count and estimation of HIV infection time and age

Of 1018 HIV-infected patients, 714 were tested for CD4+ T-cells within one year of diagnosis, accounting for 70.1%. According to the rule that the CD4+ T-cell count was reduced by an average of 50/μL per year, the infection time ≥ 8 years accounted for 25.2% (180/714), in 5-8 years accounted for 23.2% (166/714), in 3-5 years accounted for 18.3%(131/714), and <3 years accounted for 33.2% (237/714).

The average age of infection in the 714 patients was 31.0±13.1 years old. The average time from HIV infection to diagnosis was 4.7±2.4 years. The average infection time of ≥50 years old group was 5.7 ± 2.4 years, which was significantly higher than that of <50 years old group (4.6 ± 2.4 years) (t=4.500, p<0.01).

Source of blood samples in 714 HIV-infected patients who completed CD4+ T cell test within one year of diagnosis

The sample source of 714 HIV-infected patients completed CD4+ T cell test within one year of diagnosis were shown in Table 3.

The recent HIV infection rate in HIV-infected patients ≥ 50 years old

A total of 154 HIV-infected individuals ≥ 50 years old underwent recent infection test, of which, 13.6% (21/154) were diagnosed with recent HIV infection (Infection time is less than 130 days.).

The prevalence of HIV-infected patients co-infected with HBV, HCV, and syphilis

Of 1018 HIV-infected patients enrolled in this study, the prevalence of HBV, HCV, and syphilis was 11.0%, 11.1%, and 26.0%, respectively. And the prevalence of HBV-HCV, HCV-syphilis, HBV-syphilis, and HBV-HCV-syphilis was 1.7%, 2.2%, 2.6% and 0.1%, respectively (Fig.1).

Prevalence of HBV serum markers

19 kinds of HBV marker's phenotype distribution were found. Of which, 43.8% were isolated HBsAb positive, and 30.2% were negative for HBV markers. 1.6% were positive for HBsAg, HBeAg and HBcAb, while 2.9% were positive for HBsAg, HBeAb and HBcAb.

The positive rate of HBsAg in Yi Nationality (18.3%) was higher than that of Han Nationality (10.5%), and the rate of active acute HBV infection in Yi Nationality (5.6%) was significantly higher than that in Han Nationality (1.3%) ($p<0.05$),

Risk factors of HIV-HCV and HIV-syphilis co-infection

Risk factors observed by the chi-square analysis such as ethnicity, marital status, education level, and HIV transmission routes were used as factors that might affect HCV infection ($p<0.05$) (Table 2). Multivariate logistic regression analysis was conducted using stepwise regression analysis. The results showed that ethnicity, education level, and HIV transmission route were the risk factors of HCV infection in HIV-infected patients (Table 4). Factors such as age, gender, education level, and HIV transmission routes were considered factors that may affect syphilis infection (Table 2). Multivariate logistic regression analysis was performed. The age and transmission routes were the risk factors for syphilis infection in HIV-infected individuals (Table 5).

Discussion

A delayed diagnosis and treatment of HIV, HBV, HCV and syphilis can result in serious complications and sequelae such as liver cirrhosis, carcinoma, acquisition of opportunistic infections and death[37-39]. On the contrary, a timely diagnosis of these co-infections can reduce downstream adverse health effects, offset a faster disease progression, encourage cure and reduce transmission to sexual partners and children [40-42]. Timely diagnosis and treatment will cumulatively decelerate HIV, HBV, HCV and syphilis co-infection epidemics. Therefore, it is an important public health problem to assess the prevalence of these infections timely in the population. Unfortunately, like HIV-infection, there are no symptoms at the beginning of the infection, and the asymptomatic characteristics of these infections favor their quiet dissemination. In the absence of knowledge of these diseases, diagnosis and treatment, they scatter efficiently in vulnerable populations who present risk behaviors [43, 44]. According to the results of the first CD4+ T-cell test, the time interval between HIV infection and diagnosis was estimated. It was estimated that 66.8% of HIV-infected patients had been infected with HIV for more than 3 years, and 25.2% had reached more than 8 years. Meantime, the source of HIV-infected patients was mainly passive detection such as “pre-operative testing” and “other patient detection” which was much higher than the active detection method such as Voluntary Counseling & Testing (VCT), indicating that HIV-infected patients were found late[45], consistent with the experimental results. Because of similar routes of transmission and risk factors, we speculate that HBV, HCV, and syphilis infection among HIV-infected patients in this study were found late too, even they were not aware of their infection status at all when they were diagnosed with HIV. The average infection time of ≥50 years old was significantly higher than that of <50 years old group ($t=4.500$, $p<0.01$). Then, only 13.6% of HIV-infected individuals ≥50 years old were diagnosed with recent HIV infection by LAg-avidity EIA. The data indicates that late diagnosis is more severe in the elderly population. The phenomenon is likely multifactorial. Subjects ≥50 years old often do not perceive themselves to be at risk of HIV[46]. Further, stigma and a lack of knowledge of how

to access HIV testing may cause late detection and late diagnosis [47], and suggest that current sexual health services need to adapt to better meet their needs.

The epidemiological study on hepatitis B showed that the prevalence of HBsAg in Chinese population was 7.2%[48, 49], and it was 3.5% in Shaanxi population[50]. In this study, we found that the positive rate of HBsAg for HIV-infected patients in Shaanxi Province was 11.0%, which was higher than the general population in whether China or Shaanxi Province. A number of domestic studies have shown that the positive rate of HBsAg in the HIV-infected patients was higher than that of the general population, and it ranged from 13.1% to 19.4% [30-33]. However, on the contrary, some studies have reported that in HIV-infected patients, the HBsAg positive rate was slightly lower than that of the national general population. He et al found that the prevalence of HBsAg was 6.3% through a survey which enrolled 1110 cases of HIV-infected patients in central Shanxi, eastern Zhejiang, southwest Yunnan and northwestern Xinjiang[51]. Ding et al reported that the positive rate of HBsAg was 5.3% through a retrospective cohort study of HIV-infected patients receiving cART during 2004–2016[34]. The reasons for the inconsistency may be related to many factors such as region, age structure, ethnicity, time of investigation, and transmission routes, indicating that there are certain differences in HBV infection status among HIV-infected patients in different regions, and further confirmed the necessity of HBV survey in HIV-positive cases of this region.

There are few reports on the five tests for hepatitis B in the HIV/AIDS population in China. 19 kinds of HBV marker's phenotype distribution were found. Of which, the inoculated population (HBsAg-, HBsAb+, HBeAg-, HBeAb-, HBcAb-) accounted for 43.8%, which was higher than Li's study on 1314 HIV/AIDS patients (22.5%)[35]. And it was close to the hepatitis B vaccination rate of the general population in Shaanxi Province[50], which verified that the hepatitis B vaccination work in Shaanxi Province has achieved certain results. Followed by susceptible population (HBsAg-, HBsAb-, HBeAg-, HBeAb-, HBcAb-) accounted for 30.2%, similar to Li's research results (34.4%)[35], which meant that more than 30% of the HIV-infected individuals had not been effectively vaccinated against HBV, who were more susceptible to infection than the general population. The proportion of HIV-positive individuals with an active acute HBV infection was low, only 1.6%; these individuals, however, they were able to transmit HBV to other individuals very easy. At the same time, the positive rate of HBsAg in Yi Nationality (18.3%) was higher than that of Han Nationality (10.5%), and the rate of active acute HBV infection in Yi Nationality (5.6%) was significantly higher than that in Han Nationality (1.3%) ($p<0.05$), suggesting that HBV spread among HIV-positive individuals of Yi Nationality in Shaanxi.

Increases in liver-related morbidity and mortality rates among HIV-infected patients co-infected with HBV[52] suggest the importance of effective immunization against HBV among these individuals. Ideally, individuals should be vaccinated for HBV prior to be at risk for becoming HIV positive because the effectiveness of vaccination is poorer in HIV-positive than HIV-negative individuals[53]. If not previously vaccinated, HIV-positive individuals should be immunized against HBV while having a low HIV viral load, as HIV viremia shortens the duration individuals remain anti-HBs positive[54]. As anti-HBs antibodies can be lost several years after effective HBV vaccination of HIV-positive patients [55], we cannot state with certainty that study participants negative for anti-HBs had not been previously vaccinated. Regardless,

these study participants were susceptible to HBV, suggesting the need for strategies that boost immune responses in immunocompromised individuals. In short, this study has found that the positive rate of HBsAg in HIV-infected individuals was higher than that in the general population. Therefore, hepatitis B vaccination should be strengthened, especially in HIV-infected patients of Yi Nationality. At the same time, the specificity of HIV-infected persons, such as HIV viral load, should be considered.

Unlike HBV infection, there is currently no preventive HCV vaccine and the cost of treatment is enormous. The epidemiological survey showed that the prevalence of anti-HCV was 3.2% in China [56]. In 2016, the epidemiological survey of hepatitis C showed that the anti-HCV positive rate was 0.8% in the general population of Shaanxi Province. In our study, the rate of anti-HCV was 11.1% among HIV-infected patients in Shaanxi Province, which was also higher than in the general Chinese population, and 14-fold higher than in Shaanxi Province. Other studies in HIV-positive patients found both lower[35] and higher[32] HCV prevalence, ranging from 2.2% to 62.4%. Pelton et al[57] found that 2357 cases of HIV/AIDS patients in Xinjiang had an anti-HCV positive rate of 38.0%. Chen et al[32] found that the prevalence of anti-HCV was 62.4% in 978 HIV-infected patients from Hunan Province, while Li et al[35] found that the anti-HCV positive rate was only 2.2% in 1314 HIV/AIDS patients under anti-viral treatment in You'an Hospital. The results above were quite different from that in our study. Different results may be related to ethnicity, region, infection route, and investigation time. Multivariate analysis demonstrated that ethnicity, education level and transmission route were risk factors of HIV-HCV co-infection. Among 1018 HIV-infected patients, the anti-HCV positive rate of intravenous drug users was as high as 91.5%, which was the risk factor of HIV-HCV co-infection (OR=149.368, 95%CI: 16.590-1344.861). It has also been reported that the rate of HIV-HCV co-infection in Chinese intravenous drug users is as high as 69.0%-93.6%, and the infection rate of other transmission routes is significantly lower than this level[32], indicating that intravenous drug use is the cause of HCV spread in HIV-infected patients in Shaanxi. The results showed a higher prevalence in the Yi nationality than in Han nationality (*OR*=29.257, *95%CI*: 11.243-76.133). It may be caused by the high rate (41.0%) of intravenous drug use among the Yi Nationality in this study. Therefore, the publicity and intervention work should be especially strengthened in intravenous drug users and the Yi nationality.

The prevalence of syphilis was the highest of the three monitored diseases. In the HIV-infected patients with the antibody of treponema pallidum, the infection rate of homosexual transmission is so higher but heterosexual transmission is lower (*OR*=0.548 95% *CI:* 0.382-0.786), suggesting that homosexual transmission might was a risk factor for HIV/syphilis co-infection.

In conclusion, our study showed that HBV, HCV, and syphilis are wide-spread in HIV-infected patients in Shaanxi Province. And more than 30% of HIV-infected patients were not effectively vaccinated against HBV. Therefore, hepatitis virus screening is suggested to be included in routine monitoring of HIV infection. Individuals should be vaccinated for HBV prior to be at risk for becoming HIV-infected patients.

Declarations

Availability of data and material s

The data used in this study is available from the corresponding author on reasonable request.

Ethical statements

This study received ethical approval from the Ethics Committee of Shaanxi Provincial Center for Disease Control and Prevention. All experiments performed in this study were in accordance with the national laws and regulations of China.

Conflict of interest

The authors declare no conflict of interests.

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Tables

Table 1 Zhang et al.

TABLE 1 CD4+ T-cell count level and estimation of HIV infection time and age

CD4+ T-cell count level（pieces/μL）	Infection time (years)	Age of infection (years old)
≤200	≥8	Diagnostic age-8
201-249	5-8	Diagnostic age-7
250-299		Diagnostic age-6
300-349		Diagnostic age-5
350-399	3-5	Diagnostic age-4
400-449		Diagnostic age-3
≥450	<3	Diagnostic age-2

Table 2 Zhang et al.

TABLE 2 Epidemiological characteristics of HBV, HCV, TP infections in 1018 HIV-infected patients in Shaanxi Province

Due to technical limitations, Table(s) 2 is only available as a download in the supplemental files section.

Table 3 Zhang et al.

TABLE 3 Sample source in 714 HIV-infected patients who completed CD4+ T cell test within one year of diagnosis

Source of blood samples	No. of patients（n,%）
STD clinic	20(2.8)
Positive spouse/ sexual partner detection	46(6.4)
VCT	148(20.7)
Other patients/pre-blood/pre-operative tests	268(37.5)
Thematic survey	56(7.8)
Blood donation	83(11.6)
Detainee	35(4.9)
Others	58(8.1)

Table 4 Zhang et al.

TABLE 4 Multivariate Logistic Regression analysis of factors affecting HCV infection in 1018 HIV-infected patients in Shaanxi Province

Variables	*β*	*S.E*	*Wals*	*P*	*OR*(95% *CI*)
Ethnicity					
Han					1.000
Yi	3.376	0.488	47.870	0.01	29.257(11.243-76.133)
Others	1.387	0.824	2.836	0.092	4.003(0.797-20.107)
Marital status					
Unmarried					1.000
Married with spouse	0.423	0.427	0.980	0.322	1.526(0.6613-3.524)
Divorce or loss of spouse	0.737	0.507	2.114	0.146	2.089(0.774-5.638)
Unknown	2.580	0.988	6.812	0.009	13.192(1.901-91.545)
Education level					
Illiteracy					1.000
Primary School	1.650	0.724	5.189	0.023	5.208(1.259-21.543)
Junior high school	1.220	0.726	2.825	0.093	3.386(0.817-14.042)
High school /Technical secondary school	0.748	0.827	0.820	0.365	2.114(0.418-10.680)
College or above	-0.747	1.308	0.326	0.568	0.474(0.036-6.154)
Transmission routes					
Homosexual transmission					1.000
Heterosexual transmission	1.940	1.030	3.547	0.060	6.961(0.924-52.440)
Intravenous drug use	5.006	1.121	19.936	0.01	149.368(16.590-1344.861)
Unknown	1.087	1.529	0.506	0.477	2.966(0.148-59.346)
Others	4.111	1.157	12.615	0.01	61.006(6.312-589.6402)

Table 5 Zhang et al.

TABLE 5 Multivariate Logistic Regression analysis of factors affecting TP infection in 1018 HIV-infected patients in Shaanxi Province

Variables	*β*	*S.E*	*Wals*	*P*	*OR*(95% *CI*)
Age (year)					
≤20					1.000
21-	0.664	0.471	1.988	0.159	1.943(0.772-4.895)
31-	1.134	0.472	5.762	0.016	3.109(1.231-7.847)
41-	1.484	0.485	9.361	0.01	4.409(1.704-11.405)
51-	1.163	0.503	5.342	0.021	3.200(1.193-8.581)
Gender					
Male					1.000
Female	-0.595	0.307	3.747	0.053	0.552(0.302-1.008)
Education level					
Illiteracy					1.000
Primary School	0.331	0.517	0.411	0.521	1.393(0.506-3.836)
Junior high school	-0.090	0.505	0.031	0.859	0.914(0.340-2.461)
High school /Technical secondary school	0.077	0.527	0.021	0.885	1.080(0.384-3.035)
College or above	0.577	0.531	1.182	0.277	1.781(0.629-5.040)
Transmission routes					
Homosexual transmission					1.000
Heterosexual transmission	-0.602	0.184	10.657	0.01	0.548(0.382-0.786)
Intravenous drug use	-0.973	0.451	4.664	0.031	0.378(0.156-0.914)
Unknown	-1.259	0.653	3.716	0.054	0.284(0.079-1.021)
Others	-0.947	0.682	1.925	0.165	0.388(0.102-1.478)

Figures

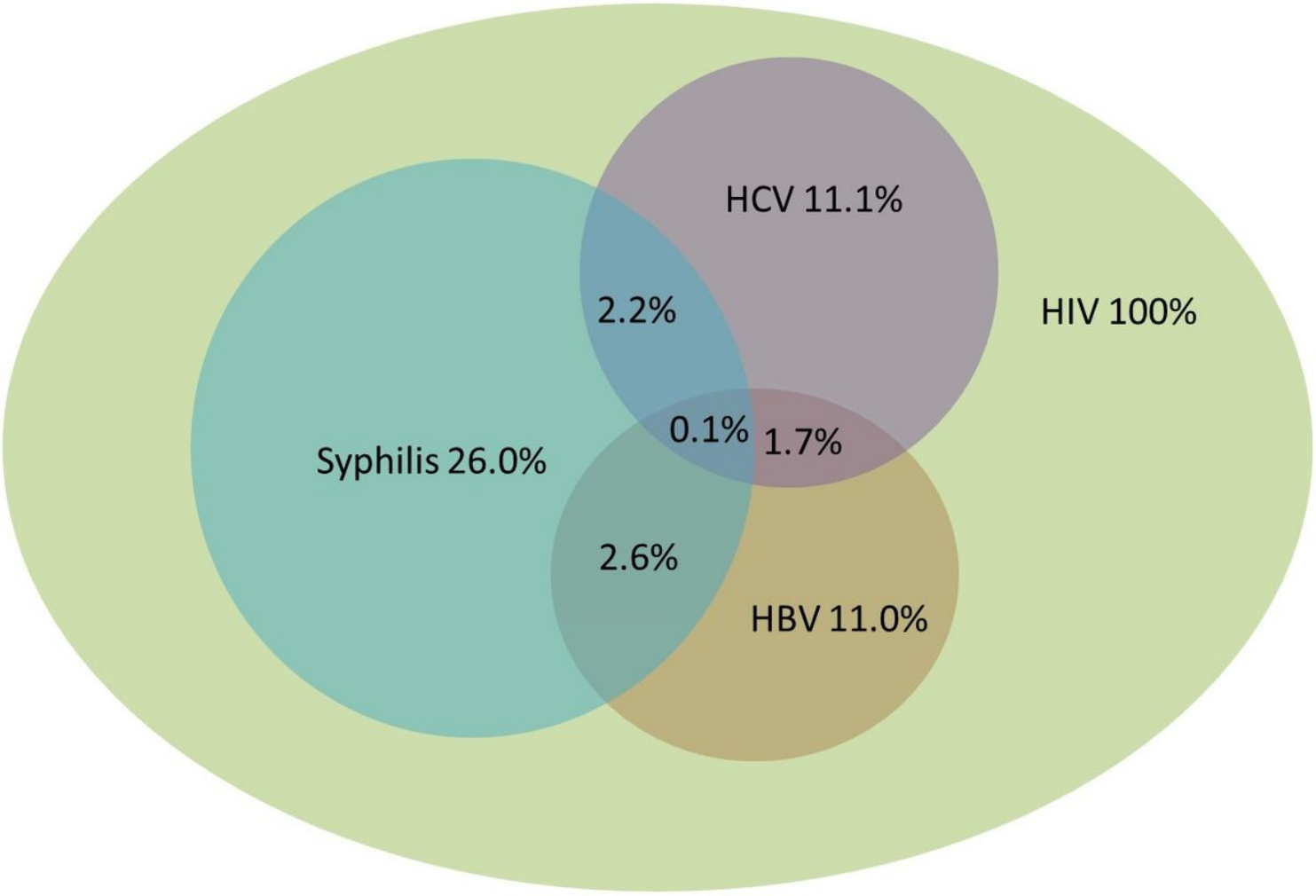

Figure 1

Prevalence of co-infection with HBV, HCV, and syphilis in 1018 HIV-infected patients

Supplementary Files

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- supplement1.pdf