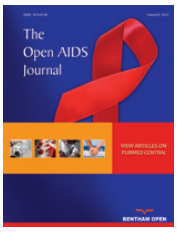
Send Orders for Reprints to reprints@benthamscience.ae

The Open AIDS Journal, 2016, *10*, 199-208

The Open AIDS Journal

Content list available at: www.benthamopen.com/TOAIDJ/

DOI: 10.2174/1874613601610010199



RESEARCH ARTICLE

Sero-prevalence and Correlates of Hepatitis B and C Co-infection Among HIV-infected Individuals in Two Regional Hospitals in Cameroon

Henry Namme Luma[1,2,*], Servais Albert Fiacre Bagnaka Eloumou[1,3], Domin Sone Majunda Ekaney[4], Fernando Kemta Lekpa[1], Olivier Donfack-Sontsa[5], Bertrand Hugo Mbatchou Ngahane[1,3] and Yacouba Njankouo Mapoure[1,3]

[1]*Internal Medicine Unit, Douala General Hospital, Douala, Cameroon*
[2]*Faculty of Medicine and Biomedical Sciences, University of Yaoundé 1, Yaoundé, Cameroon*
[3]*Faculty of Medicine and Pharmaceutical Sciences, University of Douala, Douala, Cameroon*
[4]*Faculty of Health Sciences, University of Buea, Buea, Cameroon*
[5]*London School of Hygiene and Tropical Medicine, University of London, UK*

Received: August 20, 2016 Revised: September 12, 2016 Accepted: September 13, 2016

Abstract:

Background:

Liver disease related to Hepatitis B (HBV) and C (HCV) infection has become a major cause of morbidity and mortality in HIV/AIDS patients. Data on the prevalence of HBV and HCV in Cameroon remains inconclusive.

Objective:

We aimed to determine the sero-prevalence and correlates of Hepatitis markers in HIV/AIDS patients in two Regional Hospitals.

Methods:

A cross-sectional study carried out from December 2014 to March 2015. HIV/AIDS patients aged 21 were included and above, receiving care at HIV treatment centres. Data was collected using a structured questionnaire. Blood samples were collected to screen for Hepatitis with HBsAg and anti HCV antibody rapid immunochromatographic test kits. Correlates of hepatitis were investigated by logistic regression. STATA was used for data analysis.

Results:

We included 833 HIV/AIDS patients,78.8% (657) were female. Mean age was 44(SD 11) years. Prevalence of Hepatitis in general (total of two viral markers tested) was 8.9% (74/833), with 6.1% for HBsAg and 2.8% for Anti-HCV antibodies. From multivariate analysis, the likelihood of having hepatitis was independently increased by a history of surgical interventions [OR: 1.82(1.06-3.14)], and of sexually transmitted infections [OR: 2.20(1.04-4.67)].

Conclusion:

Almost one in ten participants with HIV/AIDS attending the BRH and LRH tested positive for either HBsAg or anti HCV antibodies. Screening for HBV and HCV should therefore be integrated to the existing guidelines in Cameroon as it can influence management. More studies are needed to evaluate the extent of liver disease and magnitude of HIV suppression in hepatitis and HIV coinfection in this setting.

* Address correspondence to this author at the Douala General Hospital, P.0. Box 4856, Douala, Cameroon; Tel: 237,699960059; Fax: +237 243 37 01 46; E-mail: hnluma@yahoo.com

Keywords: Cameroon, Correlates, HBV, HCV, HIV/AIDS, Prevalence, Screening.

BACKGROUND

Human immunodeficiency virus (HIV) infection remains a major cause of morbidity and mortality worldwide [1]. An estimated 35 million (33.2-37.2 million) people were infected with HIV at the end of 2013 [2], 71% of whom were in sub-Saharan Africa (SSA). In Cameroon, the prevalence of HIV in adults is 4.3% [1, 3] with 600,000 people living with HIV [4].

Liver diseases are a major cause of morbidity and mortality among HIV/AIDS patients and they account for 15-17% of HIV-associated mortality worldwide [5]. The global mortality from liver diseases is second only to AIDS-related mortality and most of these liver diseases are of viral aetiology. Amongst the viral aetiologies 66% were linked to Hepatitis C virus (HCV), and 17% to Hepatitis B virus (HBV) [6]. HBV, HCV and HIV can co-exist [7]. The co-existence is quite permissive due to their shared modes of transmission which are mostly through sexual contact with infected individuals, contact with infected blood and blood products and vertical transmission. The prevalence of HBV in HIV approaches 10% worldwide and the risk of transmission is greatly enhanced by injection drug use and unprotected sex [8]. The reported prevalence of HCV in HIV varies significantly depending on the geographic region and mode of transmission [9, 10] ranging from 7% by sexual transmission to 91% for injection drug use [9].

With increasing access to antiretroviral therapy (ART), the burden of viral hepatitis in resource limited settings is expected to increase as is now the case in Europe and North America [11, 12]. There is therefore the concern that if this is not addressed, hepatitis virus related disease may threaten the success of ART programs in developing countries [12]. Understanding the prevalence and disease characteristics of HBV and HCV coinfection with HIV is thus essential [13]. Guidelines for the clinical management of HIV patients recommends screening for viral hepatitis but unfortunately this is not standard practice in Cameroon, as it is not included in the package of baseline laboratory tests. The few previous studies in this setting have reported the prevalence of HCV in HIV to vary between 0.6 to 12.4% while HBV in HIV was from 6.9 to 12.4% [14, 15]. Inspite of these findings, we still need more data with bigger sample sizes, for more accurate estimates of the prevalence of these coinfections especially as they are known to vary in different population groups, different regions even in the same geographical zone, and risk factors for acquiring each infection. A true prevalence of these coinfections is essential for evidence based policy making and resource allocation and planning regarding cost effective interventions especially in a context of limited resources. This will positively impact on general prevention and treatment strategies as in HBV/HIV where ART agents also possess anti HBV activity [16] and the increasing availability of affordable generic Direct acting antivirals (DAA) for HCV treatment. The objectives of this study were to determine the sero-prevalence and correlates of Hepatitis B surface antigen (HBsAg) and anti HCV positivity in HIV/AIDS patients in a regional hospital setting in Cameroon.

METHODS

Study Design and Setting

This was a hospital-based cross-sectional study carried out from 1st December 2014 to 31st March 2015 at the HIV treatment centres of the Buea (BRH) and Limbe Regional Hospitals (LRH). The BRH and LRH are both second-level referral hospitals in the South West Region, one of ten regions, in Cameroon. In Cameroon, referral hospitals are classified as level 1 (District), level 2 (Regional), level 3 (Central) and level 4 (National reference). The treatment centres function according to national guidelines with standardized HIV management protocols. Their activities include counselling, screening, follow up, dispensation of ART and Cotrimoxazole prophylaxis when indicated. Following pretest counselling, HIV is diagnosed by detection of HIV antibodies using two rapid tests (a highly sensitive first test which when positive is followed by a more specific second test). First line ART is based on standard protocols consisting of two Nucleoside Reverse Transcriptase Inhibitors (NRTIs) and one Non-Nucleoside Reverse Transcriptase Inhibitor (NNRTI). The preferred treatment regimen consists of Tenofovir/Lamivudine/Efavirenz. Second line treatment is reserved for those who have treatment failure to first line as defined by clinical, immunological, or virological parameters. It consists of two NRTI and one boosted protease inhibitor (Lopinavir). CD4 count testing is recommended six monthly.

Study Population and Procedures

The study population included in this study were HIV/AIDS infected individuals aged 21 and above who were

enrolled in the HIV/AIDS treatment centres of the BRH and LRH. Participants were recruited by consecutive sampling as they presented for their monthly follow-up sessions in the different treatment centres. Written informed consent was obtained from each individual who agreed to participate. A face to face interview by a trained investigator (final year medical student) was conducted using a structured, pretested questionnaire. Patient files were used to complete the required information. Data collected was demographic (Age, sex), level of education (no education, Primary, Secondary and Tertiary), comorbidities (hypertension, diabetes mellitus, stroke, malignancy, heart failure, alcohol consumption-yes or no- and smoking), potential risk factors for acquiring viral hepatitis (scarifications, piecing, tattoo, blood transfusion, surgery, induced abortions, sexual partners -one or if more than one termed multiple-, intravenous (IV) drug use, history of sexually transmitted infection (STI) and liver disease), HIV care characteristics (duration since HIV diagnosis, HIV World Health Organisation (WHO) clinical staging, history of opportunistic infections, most recent CD4 count, ART regimen and duration). Information on comorbidities and potential risk factors was through questions requiring Yes or No response.

Blood Sample Collection and Sample Testing

Participants were initially counselled on hepatitis viral infections. Then, venous blood (4 mL) was collected into coded dry tubes per participant using vacutainer needles. The blood containing tubes were taken to the respective hospital laboratory for separation and hepatitis B and C screening. Serum from the dry tubes was obtained after centrifugation at 3000 rpm for 5 minutes. Then using a micropipette, 2ml of each participant's serum was tested for HBsAg and anti HCV antibodies using INTEC Products (Fujian China (Mainland) rapid screening kits (sensitivity and specificity at greater than 99%). Manufacturer's instructions were strictly followed. Each test kit was a lateral flow qualitative immunochromatographic assay. A positive control sample for hepatitis B and C was used to control the validity for each packet of the reagent before use. The result of the test for presence of HBsAg and or anti-HCV was recorded in the corresponding section of the questionnaire. The patients were individually and privately informed of their results. HBV/HIV coinfection was defined by a positive HBsAg and HCV/HIV coinfection by a positive anti HCV antibody test. Participants who tested positive for HBsAg were treated with Tenofovir containing ARV's and those positive for Anti-HCV were referred to the Internist or gastroenterologist for further management. All results were recorded in their individual medical files. At the end of each day, the filled questionnaires were cross-checked and validated by the principal investigator.

Statistical Analysis

We used STATA 12.0 for windows (STATA corp, college station, TX, USA) for data analysis. Participant's characteristics were reported as count and percentages and mean and standard deviation, and compared them across major subgroups *via* Chi square tests and equivalents for qualitative variables, and Student's t-test for continuous variables. For further analysis, we categorized some continuous variables without any clinical cut-off at their medians and described hepatitis as carrying any of the 2 markers (HBsAg and anti-HCV antibodies). Thus associated factors of hepatitis were analysed by univariable logistic regression reporting Odds ratios (OR) and their 95% confident intervals (CI). All significant variables were mutually introduced in a final multivariable logistic regression model. A p-value <0.05 was used to indicate statistically significant results.

Ethical Considerations

Ethical Clearance was obtained from the Institutional Review Board of the Faculty of Health sciences, University of Buea (Approval number 2014/258/UB/FHS/IRB). Administrative authorization was sought and obtained from the Regional Delegation of the Ministry of Public Health. Thereafter, administrative approval was sought and obtained from the directors of both hospitals. Confidentiality, anonymity and privacy of all participants were guaranteed at all levels of this study. Written consent was provided by each and every participant.

RESULTS

Baseline Characteristics

A total of 833 patients with HIV were recruited, 632 from LRH and 201 from BRH. Table **1** depicts the baseline characteristics of the study population. The Mean age was 44 (SD 11) years and 78.9% were female. The median duration of HIV infection from diagnosis was 5 [IQR 3-9] years, and almost all the patients were on ART with a median duration of treatment of 5 [IQR 2-8] years. More than half of them (53%) were classified WHO clinical stage 3 and

median CD4 cell count was 419 [IQR 250-593] cells/mm^3.

Table 1. Baseline characteristics of the study population.

Variables	Frequency	Percentage
Age (n=833)		
21-39	325	39.0
40-59	420	50.4
>60	88	10.6
Sex (n=833)		
Female	657	78.9
Male	176	21.1
Level of Education (n=829)		
No education	37	4.5
Primary	446	53.8
Secondary	286	34.5
Tertiary	60	7.2
Duration of HIV Infection from diagnosis (n=829)		
< 1year	39	4.7
1- 5 years	376	45.4
>5 years	414	49.9
ART (n=831)		
No	5	0.6
Yes	826	99.4
ART Regimen (n = 826)		
1st Line	784	94.9
2nd line	42	5.1
Duration of HIV Treatment (n=826)		
< 1 year	38	4.6
1-5 years	424	51.3
>5 years	364	44.1
WHO clinical staging (n= 710)		
Stage 1	85	11.9
Stage 2	188	26.5
Stage 3	377	53.1
Stage 4	60	8.5
CD4 category, cells/mm3 (n=650)		
<50	37	5.7
50-199	92	14.1
200-499	276	42.5
≥ 500 Opportunistic Infection (818)	2 228	37.7 27.9

ART: antiretroviral therapy; CD4: cluster of differentiation 4; WHO: World Health Organisation.

Comorbidities and Risk Behaviours

Known hypertensive and diabetic patients were almost 5% and 2% respectively. 27.7% of participants admitted to alcohol consumption. Amongst probable risk factors for acquiring viral hepatitis B and C, scarification was the most practiced (53%), followed by induced abortion in women (28%) and alcohol consumption (27%). Twenty one percent reported a history of blood transfusion (21%) and 9% reported a history of STI. Only 6 participants declared being IV drug users, none of whom were co-infected (Table **2**).

Prevalence and Correlates of Hepatitis

No study participant admitted to previous screening for HBV and HCV. The overall sero-prevalence of both Hepatitis B and C was 8.9% (95%CI 7.04%-11.02%). Hepatitis B surface antigen (HBsAg) and anti-hepatitis C antibodies were found respectively in 6.1% (51) and 2.8% (23) of the study participants. 80.4% (41/51) of HBSag

positive patients were on Tenofovir containing regimens. No participant had both markers for HBV and HCV.

Table 2. Comorbidities and risk factors by type of hepatitis.

Variables	Total (N=833)	Hepatitis B (N=51) n(%)	Hepatitis C (N=23)n(%)
Co-morbidities			
Hypertension	39 (4.68)	1 (1.96)	1 (4.35)
Diabetes Mellitus	14 (1.68)	1 (1.96)	0 (0.00)
Stroke	11 (1.32)	1 (1.96)	1 (4.35)
Malignancy	8 (0.96)	0 (0.00)	0 (0.00)
Heart Failure Alcohol consumption Cigarette smoking	2 (0.24) 231 (27.7) 21 (2.5)	0 (0.00) 18 (35.29) 2 (3.92)	0 (0.00) 5 (21.74) 1 (4.35)
Risk Factors and Behaviours			
Scarification	444 (53.3)	26 (50.98)	11 (47.83)
History of Induced Abortion	187 (28.5)	6 (11.76)	4 (17.39)
Blood transfusion	182 (21.9)	9 (17.65)	6 (26.09)
Surgical intervention	180 (21.6)	15 (29.41)	8 (34.78)
Multiple sexual partners	160 (19.2)	18 (35.29)	3 (13.04)
History of STIs	76 (9.13)	10 (19.61)	2 (8.70)
Piercing	66 (7.9)	1 (1.96)	3 (13.04)
Tattoo	45 (5.4)	3 (5.88)	1 (4.35)
History of Liver Disease	24 (2.9)	0 (0.00)	1 (4.35)
IV drug users	6 (0.7)	0 (0.00)	0 (0.00)

STIs: sexually transmitted infections.

From univariable analysis, participants with a history of a surgical intervention [OR 1.73 (95%CI 1.02-2.92)], having multiple sexual partners [OR 1.76 (95%CI 1.03-3.03)] and a history of STIs [OR 2.09 (95%CI 1.07-4.10)] had an increased likelihood of having either of the two markers for hepatitis B and C. On the other hand, patients classified as WHO clinical stage 3 and 4 had higher chances of having hepatitis than those classified as stage 1 and 2 [OR 1.63 (95%CI 0.95-2.89) P=0.07] as well as those with a history of opportunistic infections [OR 1.58 (95%CI 0.96-2.62) P=0.07] though not statistically significant. From multivariable logistic regression, surgical intervention [OR 1.82 (95%CI 1.06-3.14)] and history of STIs [OR 2.20 (95%CI 1.04-4.67)] were independent correlates of both hepatitis B and C when analysed together (Table **3**). In Table **4**, HBV/HIV and HCV/HIV co-infection were analysed separately. In the univariable analysis there was evidence of association between HBV/HIV coinfection with having multiple sexual partners and a history of STIs. However, this is not supported by the multivariable model. No such association was seen in HCV/HIV coinfection with all the parameters analysed.

Table 3. Correlates of the total of the two markers for hepatitis B and C co-infection in the study population.

Factors	Univariate analysis		Multivariate analysis	
	OR (95% CI)	*P*	OR (95%CI)	*P*
Age, ≥42years	1.17(0.73-1.89)	0.52		
Sex: Male	1.43(0.83-2.46)	0.19		
HIV infection, ≥5 years	1.13(0.69-1.82)	0.62		
ART duration, ≥5 years	1.12(0.68-1.80)	0.65		
WHO, stage 3&4	1.63(0.95-2.81)	0.07	1.44(0.82-2.52)	0.21
CD4, ≥200cells/mm3	0.74(0.39- 1.40)	0.36		
OIs, yes	1.58(0.96-2.62)	0.07	1.26(0.75-2.14)	0.39
Alcohol consumption, yes	1.19(0.71-2.00)	0.50		
Smoking, yes	1.73(0.49-6.05)	0.38		
Scarification, yes	0.86(0.53-1.39)	0.55		
Tattoo, yes	0.99(0.35-2.87)	0.99		
Piercing, yes	0.64(0.23-1.82)	0.40		
Blood transfusion, yes	0.90(0.50-1.63)	0.73		
Surgery, yes	1.73(1.02-2.92)	0.038	1.83(1.06-3.14)	0.03
Multiple sexual partners, yes	1.77(1.03-3.03)	0.036	1.46(0.80-2.69)	0.22

(Table 3) contd.....

Factors	Univariate analysis		Multivariate analysis	
	OR (95% CI)	*P*	OR (95%CI)	*P*
History of STIs, yes	2.09(1.07-4.10)	0.027	2.20(1.04-4.68)	0.04
History of liver disease, yes	0.44(0.10-3.30)	0.41		

OI: opportunistic infection; STIs: sexually transmitted infections; ART: antiretroviral therapy; CD4: cluster of differentiation 4, OR: Odds ratio; CI: confidence interval.

Variables such as age, duration of HIV infection and treatment were categorized at their medians before being entered in univariable analysis and all variables that reached significance at the level of 10% in univariable analysis were entered by default in the final multivariable analysis.

Table 4. Correlates of hepatitis B and hepatitis C co-infection analysed separately (N=833).

Factors	HBV/HIV Co-infection				HCV/HIV Co-infection	
	Univariable		Multivariable		Univariable	
	OR (95% CI)	*P*	OR (95%CI)	*P*	OR (95% CI)	*P*
Age, ≥42years	1.1(0.61 - 1.9)	0.78			1.28(0.54 - 2.99)	0.57
Sex: Male	1.95(1.06 - 3.6)	0.03	1.64(0.87 - 3.1)	0.12	0.55(0.16 - 1.88)	0.34
HIV infection, ≥5 years	1.14 (0.64 - 2.0)	0.66			1.09(0.48 - 2.51)	0.83
ART duration, ≥5 years	1.09(0.61 - 1.92)	0.78			1.17(0.51 - 2.68)	0.71
WHO, stage 3&4	1.66(0.88 - 3.14)	0.12			1.47(0.56 - 3.89)	0.43
CD4, ≥200cells/mm3	0.85(0.39 - 1.84)	0.69			0.57(0.20 - 1.66)	0.30
OIs, yes	1.89(1.06 - 3.39)	0.03	1.75(0.96 - 3.16)	0.07	0.97(0.37 - 2.51)	0.94
Alcohol consumption, yes	1.45(0.80 - 2.65)	0.21			0.72(0.26 - 1.96)	0.51
Smoking, yes	1.64(0.37 - 7.25)	0.51			1.80(0.23 - 14.0)	0.57
Scarification, yes	0.91(0.51 - 1.59)	0.73			0.79(0.35 - 1.83)	0.59
Tattoo, yes	1.09(0.33 - 3.68)	0.88			0.79(0.10 - 5.9)	0.82
Piercing, yes	0.22(0.03 - 1.63)	0.10	0.22(0.03 - 1.64)	0.14	1.78(0.51 - 6.16)	0.36
Blood transfusion, yes	0.75(0.36 - 1.58)	0.45			1.27(0.49 - 3.28)	0.62
Surgery, yes	1.55(0.83 - 2.91)	0.16			1.98(0.82 - 4.75)	0.12
Multiple sexual partners, yes	2.46(1.34 - 4.5)	0.003	1.79(0.91 - 3.52)	0.09	0.62(0.18 - 2.13)	0.45
History of STIs, yes	2.64(1.26 - 5.53)	0.007	2.13(0.93 - 4.84)	0.07	0.95(0.22 - 4.12)	0.94
History of liver disease, yes	/				1.56(0.20 - 12.1)	0.67

DISCUSSION

The overall prevalence of both HBsAg and anti HCV antibodies in this studywas 8.9%. A history of previous surgery and sexually transmitted infections was shown to be independently associated with this overall prevalence. When considered separately, the sero-prevalence of HBsAg was 6.1%. There was some evidence that male gender, a history of opportunistic infections, multiple sexual partners and STIs were associated with HBV/HIV co-infection. Anti HCV antibody sero-prevalence was 2.8%. Neither socio-demographic, potential risk factors for acquiring hepatitis, nor HIV characteristics were shown to be associated with HCV/HIV co-infection.

We used rapid HBsAg and anti HCV antibody tests. They can be a powerful tool for screening at the point of care. They identify persons infected with these viruses so that preventive services, additional investigations, care and treatment can be offered immediately. Tested persons are thus: notified of their infection status, enabled to make informed decisions about medical care and options for treatment, able to be advised to take measures to limit hepatitis associated disease progression for example as regards alcohol intake, be vaccinated against Hepatitis B, and have a minimised risk of transmission to others [17]. The sensitivity of rapid testing has been questioned by some authors [18]. It remains unclear whether HIV serostatus affects test performance [18]. However another author [19] found HBsAg rapid diagnostic test as an accurate assay for screening for HBsAg in HIV infected patients in a SSA setting.

Liver disease remains an important modifier of health in persons with HIV [20]. The negative effects of HIV infection with progression of HBV and HCV infection is well established with high rates of viral persistence, higher hepatitis viral load and a more rapid progression to liver fibrosis and hepato-cellular carcinoma in co-infected patients [11]. It is therefore unfortunate that screening for HBV and HCV is not routine in Cameroon at the initial assessment of HIV positive patients. None of our study participants admitted to have been previously screened for HCV and HBV infection.

A sero-prevalence of HBsAg of 6.1% was similar to another study in the same region, using a similar methodology but with a smaller sample size [15]. Other studies conducted in Kenya and Ethiopia [21 - 23] found a similar prevalence as ours. One study in Cameroon with a smaller study population found a prevalence of 8.3%. The study setting, patient characteristics (Median CD4 count was 135) and methodology were different. Poymerase chain reaction (PCR) test was used to diagnose HBV and HCV infection [14]. A much higher prevalence of 11 to 20% was found in Nigeria [24, 25] Malawi [26] and Senegal [27]. In a systematic review and meta-analysis aimed at determining the prevalence of HBV and HCV in HIV infected individuals in SSA, the prevalence of HBsAg in HIV in Cameroon in the study used was 20% of 20 study participants [7, 28]. This is unlikely to reflect the burden of HBV in HIV. No recent studies have corroborated these findings.

Only 2.8% of our study participants were anti HCV antibody positive. This prevalence is much lower than the known prevalence of HCV in the general population in Cameroon which is around 13.8% [29]. However another author in Cameroon, using a similar methodology, also reported a prevalence below that of the general population [15]. A prevalence of HCV in HIV below 5% has been found in other African countries [23, 25, 30, 31]. Using data from studies carried out between 2002 and 2014, a systematic review aimed at determining the prevalence of HCV in HIV co-infection in SSA, found the overall pooled sero-prevalence of HCV coinfection in HIV infected individuals was 5.73% [32]. There were fewer studies included from our Central African region compared to West and South East Africa. Again, paradoxically, these prevalence for a high risk population, as HIV positive patients, were lower than that of the general population. However, general population prevalence for HCV may be reviewed in the future as large population surveys are now being done in these regions. For example two recent populations based studies in Cameroun found a prevalence of HCV of 2.55% and 1.1% from a study population of 23.990 [33] and 14.150 [34] respectively.

Prevalence rates of these HBV and HCV co-infections can vary according to the risk factors involved [35]. Such data is not always available in this setting. A history of previous surgery and STI was independently associated with the overall prevalence of both co-infections. Surgery in our setting may still have inherent risks related to lapses in asepsis and blood transfusions which both increase the risk of iatrogenic and nosocomial transmission of these infections [36]. A history of STI and to a lesser extent from this study, multiple sex partners were associated with both HBV and HCV coinfection. This was similar to those of another author [37]. Explanation for HBV than HCV coinfection is easier. Sexual transmission of HBV and HIV is more efficient than for HCV [38].

There were some limitations to this study. Diagnosis of HBV and HCV co-infections was based on the detection of HBsAg and anti HCV antibodies by use of rapid tests with no confirmation by ELISA. Neither was molecular testing done, whereas absence of HCV RNA has been described in 10 to 50% of anti HCV antibody positive patients in some studies [37]. In addition to finding out the sero-positivity of our study participants, additional data on the extent of liver disease, and the magnitude of HIV suppression by use of viral loads could have contributed more to an improved understanding of the impact of hepatitis and HIV coinfection. Also, information on some known risk factors for acquiring hepatitis, particularly sexual history and practices, was lacking. Lastly, our findings cannot be generalised as they reflect the sero-prevalence among individuals in only one region in Cameroon.

CONCLUSION

The prevalence of HBsAg and anti HCV antibodies was lower than expected for a high-risk group like this (patients living with HIV/AIDS) as well as that in published data for the general population in Cameroon. Nevertheless, as almost one in ten participants living with HIV/AIDs tested positive for one of these viral markers, screening for HBV and HCV should be integrated to the existing guidelines in Cameroon as it can influence management. A history of STI and undergone surgery was correlated with hepatitis B and C infection. More research is needed to confirm our data and to study the impact of these coinfections on the evolution of HIV/AIDS in this setting.

LIST OF ABBREVIATIONS

AIDS	=	Acquired immunodeficiency Virus
ART	=	Antiretroviral therapy
ART	=	Antiretroviral treatment
BRH	=	Buea Regional Hospital
CD4	=	Cluster of differentiation 4
CI	=	Confidence interval

DAA	=	Direct acting antivirals
ELISA	=	Enzyme linked immunosorbent assay.
HBSag	=	Hepatitis B surface antigen
HBV	=	Hepatitis B Virus
HCV	=	Hepatitis C Virus
HIV	=	Human Immunodeficiency Virus
IV	=	Intravenous
LRH	=	Limbe Regional Hospital
OI	=	Opportunistic infection
OR	=	Odds ratio
PCR	=	Polymerase Chain Reaction: WHO: World Health Organisation
SSA	=	Sub-Saharan Africa
STIs	=	Sexually transmitted infections

AUTHORS CONTRIBUTIONS

HNL, BHMN, YNM, DSME, and SAFBE conceived the study. DE collected the data while DSME, FKL entered the data. HNL, FKL, DSME and ODS analyzed the data and drafted the manuscript. HNL, SAFBE, BHMN, YNM, FKL and OSD proofread and corrected the manuscript. All authors agreed with the final manuscript to be submitted for publication

CONFLICT OF INTREST

The authors confirm that this article content has no conflict of interest.

ACKNOWLEDGEMENTS

The authors are thankful to the members of the HIV/AIDS treatment centres of the BRH and LRH and also the patients who accepted to participate in this study.

REFERENCES

[1] UNAIDS Report on Gobal AIDS Epidemic 2013. USA: World Health Organization 2013.

[2] UNAIDS. Global Statistics Report 2013. Fact sheet 2014. Available from: http://files.unaids.org/en/media/unaids/contentassets/documents/factsheet/2014/20140716_FactSheet_en.pdf

[3] Rapport Préliminaire sur la Prévalence du VIH. Tunisia: Institut National de la Statistique 2011.

[4] Unaids Global Aids Response. USA: UNAIDS 2014.

[5] Butt AA. Epidemiology of Liver Disease in Human Immunodeficiency Virus-Infected Persons. In: HIV and Liver Disease. London: Springer Science+Business Media 2012.
[http://dx.doi.org/10.1007/978-1-4419-1712-6_2]

[6] Joshi D, OGrady J, Dieterich D, Gazzard B, Agarwal K. Increasing burden of liver disease in patients with HIV infection. Lancet 2011; 377(9772): 1198-209.
[http://dx.doi.org/10.1016/S0140-6736(10)62001-6] [PMID: 21459211]

[7] Barth RE, Huijgen Q, Taljaard J, Hoepelman AI. Hepatitis B/C and HIV in sub-Saharan Africa: an association between highly prevalent infectious diseases. A systematic review and meta-analysis. Int J Infect Dis 2010; 14(12): e1024-31.
[http://dx.doi.org/10.1016/j.ijid.2010.06.013] [PMID: 20870439]

[8] Badridze N, Chkhartishvili N, Abutidze A, Gatserelia L, Sharvadze L. Prevalence of hepatitis B and C among HIV positive patients in Georgia and its associated risk factors. Georgian Med News 2008; (165): 54-60.
[PMID: 19124918]

[9] Bräu N. HIV/HCV Coinfection - Viral Interactions and Therapy. New York: Mount Sinai School of Medicine: Divisions of Infectious Diseases & Liver Disease 2012.

[10] Rotman Y, Liang TJ. Coinfection with hepatitis C virus and human immunodeficiency virus: virological, immunological, and clinical outcomes. J Virol 2009; 83(15): 7366-74.
[http://dx.doi.org/10.1128/JVI.00191-09] [PMID: 19420073]

[11] Milazzo L, Antinori S. Hepatitis virus and HIV interactions. Lancet Infect Dis 2014; 14(11): 1025-7.
[http://dx.doi.org/10.1016/S1473-3099(14)70853-9] [PMID: 25303842]

[12] Xie J, Han Y, Qiu Z, *et al.* Prevalence of hepatitis B and C viruses in HIV-positive patients in China: a cross-sectional study. J Int AIDS Soc 2016; 19(1): 20659.
[http://dx.doi.org/10.7448/IAS.19.1.20659] [PMID: 26979535]

[13] Matthews PC, Beloukas A, Malik A, *et al.* Prevalence and Characteristics of Hepatitis B Virus (HBV) Coinfection among HIV-Positive Women in South Africa and Botswana. PLoS One 2015; 10(7): e0134037.
[http://dx.doi.org/10.1371/journal.pone.0134037] [PMID: 26218239]

[14] Laurent C, Bourgeois A, Mpoudi-Ngolé E, *et al.* High rates of active hepatitis B and C co-infections in HIV-1 infected Cameroonian adults initiating antiretroviral therapy. HIV Med 2010; 11(1): 85-9.
[http://dx.doi.org/10.1111/j.1468-1293.2009.00742.x] [PMID: 19659944]

[15] Ottop FM, Atashili J, Ndumbe PM. Impact of antiretroviral therapy on glycemia and transaminase levels in patients living with HIV/AIDS in Limbe, Cameroon. J Int Assoc Provid AIDS Care 2013; 12(1): 23-7.
[http://dx.doi.org/10.1177/1545109712447199] [PMID: 22699715]

[16] Agyeman AA, Ofori-Asenso R. Prevalence of HIV and hepatitis B coinfection in Ghana: a systematic review and meta-analysis. AIDS Res Ther 2016; 13: 23.
[http://dx.doi.org/10.1186/s12981-016-0107-x] [PMID: 27190544]

[17] Centers for Disease Control and Prevention (CDC). Testing for HCV infection: an update of guidance for clinicians and laboratorians. MMWR Morb Mortal Wkly Rep 2013; 62(18): 362-5.
[PMID: 23657112]

[18] Hoffmann CJ, Charalambous S, Martin DJ, *et al.* Hepatitis B virus infection and response to antiretroviral therapy (ART) in a South African ART program. Clin Infect Dis 2008; 47(11): 1479-85.
[http://dx.doi.org/10.1086/593104] [PMID: 18937580]

[19] Franzeck FC, Ngwale R, Msongole B, *et al.* Viral hepatitis and rapid diagnostic test based screening for HBsAg in HIV-infected patients in rural Tanzania. PLoS One 2013; 8(3): e58468.
[http://dx.doi.org/10.1371/journal.pone.0058468] [PMID: 23469281]

[20] Soriano V, Barreiro P, Sherman KE. The changing epidemiology of liver disease in HIV patients. AIDS Rev 2013; 15(1): 25-31.
[PMID: 23449226]

[21] Harania RS, Karuru J, Nelson M, Stebbing J. HIV, hepatitis B and hepatitis C coinfection in Kenya. AIDS 2008; 22(10): 1221-2.
[http://dx.doi.org/10.1097/QAD.0b013e32830162a8] [PMID: 18525268]

[22] Muriuki BM, Gicheru MM, Wachira D, Nyamache AK, Khamadi SA. Prevalence of hepatitis B and C viral co-infections among HIV-1 infected individuals in Nairobi, Kenya. BMC Res Notes 2013; 6: 363.
[http://dx.doi.org/10.1186/1756-0500-6-363] [PMID: 24016453]

[23] Wondimeneh Y, Alem M, Asfaw F, Belyhun Y. HBV and HCV seroprevalence and their correlation with CD4 cells and liver enzymes among HIV positive individuals at University of Gondar Teaching Hospital, Northwest Ethiopia. Virol J 2013; 10: 171.
[http://dx.doi.org/10.1186/1743-422X-10-171] [PMID: 23721493]

[24] Otegbayo JA, Taiwo BO, Akingbola TS, *et al.* Prevalence of hepatitis B and C seropositivity in a Nigerian cohort of HIV-infected patients. Ann Hepatol 2008; 7(2): 152-6.
[PMID: 18626434]

[25] Adewole OO, Anteyi E, Ajuwon Z, *et al.* Hepatitis B and C virus co-infection in Nigerian patients with HIV infection. J Infect Dev Ctries 2009; 3(5): 369-75.
[http://dx.doi.org/10.3855/jidc.245] [PMID: 19759507]

[26] Nyirenda M, Beadsworth MB, Stephany P, *et al.* Prevalence of infection with hepatitis B and C virus and coinfection with HIV in medical inpatients in Malawi. J Infect 2008; 57(1): 72-7.
[http://dx.doi.org/10.1016/j.jinf.2008.05.004] [PMID: 18555534]

[27] Diop-Ndiaye H, Touré-Kane C, Etard JF, *et al.* Hepatitis B, C seroprevalence and delta viruses in HIV-1 Senegalese patients at HAART initiation (retrospective study). J Med Virol 2008; 80(8): 1332-6.
[http://dx.doi.org/10.1002/jmv.21236] [PMID: 18551596]

[28] Mbanya DN, Takam D, Ndumbe PM. Serological findings amongst first-time blood donors in Yaoundé, Cameroon: is safe donation a reality or a myth? Transfus Med 2003; 13(5): 267-73.
[http://dx.doi.org/10.1046/j.1365-3148.2003.00453.x] [PMID: 14617337]

[29] Madhava V, Burgess C, Drucker E. Epidemiology of chronic hepatitis C virus infection in sub-Saharan Africa. Lancet Infect Dis 2002; 2(5): 293-302.
[http://dx.doi.org/10.1016/S1473-3099(02)00264-5] [PMID: 12062995]

[30] Pirillo MF, Bassani L, Germinario EA, *et al.* Seroprevalence of hepatitis B and C viruses among HIV-infected pregnant women in Uganda and Rwanda. J Med Virol 2007; 79(12): 1797-801.
[http://dx.doi.org/10.1002/jmv.21007] [PMID: 17935164]

[31] Msuya SE, Mbizvo EM, Hussain A, Sam NE, Stray-Pedersen B. Seroprevalence of hepatitis B and C viruses among women of childbearing age in Moshi Urban, Tanzania. East Afr Med J 2006; 83(2): 91-4.

[http://dx.doi.org/10.4314/eamj.v83i2.9394] [PMID: 16708880]

[32] Rao VB, Johari N, du Cros P, Messina J, Ford N, Cooke GS. Hepatitis C seroprevalence and HIV co-infection in sub-Saharan Africa: a systematic review and meta-analysis. Lancet Infect Dis 2015; 15(7): 819-24.
[http://dx.doi.org/10.1016/S1473-3099(15)00006-7] [PMID: 25957078]

[33] Biwole-Sida M, Noah D, Eloumou AF, Dang I, Talla P. Carriage prevalence of HCV markers in the working environment (Cameroun). J Africain d'Hépato-Gastroentérologie 2015; 9(1): 26-9.
[http://dx.doi.org/10.1007/s12157-014-0581-5]

[34] Njouom RT, Texier G, Fontanet A. Prevalence of hepatitis B, hepatitis C and hepatitis D virus infections in Cameroon: results from a national population based survey (The ANRS 12289 project). J Viral Hepat 2015; 22(Suppl. S2): 1-18.
[http://dx.doi.org/10.1111/jvh.01_12424]

[35] Kerubo G, Khamadi S, Okoth V, *et al.* Hepatitis B, hepatitis C and HIV-1 coinfection in two informal urban settlements in Nairobi, Kenya. PLoS One 2015; 10(6): e0129247.
[http://dx.doi.org/10.1371/journal.pone.0129247] [PMID: 26068212]

[36] Mboto CI, Davies A, Fielder M, Jewell AP. Human immunodeficiency virus and hepatitis C co-infection in sub-Saharan West Africa. Br J Biomed Sci 2006; 63(1): 29-37.
[http://dx.doi.org/10.1080/09674845.2006.11732716] [PMID: 16613141]

[37] Brandão NA, Pfrimer IA, Martelli CM, Turchi MD. Prevalence of hepatitis B and C infection and associated factors in people living with HIV in Midwestern Brazil. Braz J Infect Dis 2015; 19(4): 426-30.
[http://dx.doi.org/10.1016/j.bjid.2015.02.001] [PMID: 25766773]

[38] Weldemhret L, Asmelash T, Belodu R, Gebreegziabiher D. Sero-prevalence of HBV and associated risk factors among HIV positive individuals attending ART clinic at Mekelle hospital, Tigray, Northern Ethiopia. AIDS Res Ther 2016; 13: 6.
[http://dx.doi.org/10.1186/s12981-016-0090-2] [PMID: 26855663]