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Current status of human immunodeficiency virus and hepatitis C virus (HIV/HCV) co-infection in Cameroon: Sero-prevalence, risk factors and correlation with markers of liver function and CD4 cells rate in patients diagnosed in three hospital settings

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This study investigates the current status of HIV/HCV co-infection through viral sero-prevalence and correlation with liver markers and CD4 count in three hospital settings in Cameroon. Blood samples of 75 newly diagnosed HIV patients, and 546 people attending the target hospitals were screened for HCV(antigen-antibodies) using enzyme-immunoassay. Biochemical liver markers (ALT-AST-γ-GT-Bilirubin) and CD4-cell count were also analyzed. Statistical analysis was performed using student's t-test, χ2-test and Pearson correlation. The statistical significance was set at the threshold p≤0.05. Out of 75 people with HIV, 10(13.33%) were diagnosed with HIV/HCV co-infection; 56(10.25%) individuals from the cohort of 546 participants were diagnosed with HCV infection and 5(8.93%) were confirmed HIV positive. Results showed that HCV infection rate is higher among HIV patients than among the general population. For the two populations, co-infection rate was higher in women: 7(9.3%) and 3(4%) respectively in HIV positive patients, 3(5.35%) and 2(3.57%) in HCV patients. Women comprised the majority of people with HIV (72%) while men were the majority in the HCV-infected population (78.57%). Mean age in co-infected individuals was higher, with 93.33% aged 50 years or above. A negative and significant correlation was associated with CD4 count, ALT activity and bilirubin concentration in people with HIV, whereas in HIV/HCV co-infected patients, positive and significant correlations were associated with ALT, AST and γ-GT. HIV/HCV co-infection is a concern in hospital settings in Cameroon. HCV screening should be compulsory for patients and integrated in the existing guidelines/policies in Cameroon.

Key words: Seroprevalence, HIV/HCV, co-infection, risk factor, correlation, disease stage.

INTRODUCTION

Human immunodeficiency virus/hepatitis C virus (HIV/HCV) co-infection is becoming an important factor of co-morbidity and mortality, but many settings in sub-Saharan Africa still face disease unawareness even in

hospital surroundings. Viral infections are among the most serious worldwide public health problems, affecting millions of people worldwide. Sub-Saharan Africa that represents only 13% of the world population is the hardest hit region by these infections, home to nearly 70% of people living with human immunodeficiency virus infection and acquired immune deficiency syndrome (HIV/AIDS) (PLHIV).In 2015, there were 36.7 million people living with HIV, including 2.1 million new infections. Western and Central Africa are home to 18% (6.5 million) of these infections, right after the Eastern and Southern Africa, 52% (19.0 million) and before Asia and the Pacific, 14% (5.1 million) (UNAIDS, 2016). Cameroon remains in a situation of high incidence for HIV, with a seroprevalence of 4.3% in adults aged 15 to 49 years (National Institute of Statistics, 2011).

The global response to the HIV/AIDS epidemic has improved human health: the effectiveness of highly active antiretroviral therapy (HAART) in improving the quality and lifespan of HIV patients has revolutionized the field of HIV care. However, co-infections with viruses like hepatitis B (HBV) and hepatitis C (HCV) appear to compromise the benefits of efficient antiretroviral drugs by increasing the morbidity and mortality in HIV-infected populations. Chronic hepatitis C has been reported as major cause of liver diseases in HIV infected people (Soriano et al., 2011). It is now well known that HIV/HCV co-infected patients are three times more likely to develop complications than those who are HIV mono-infected (Kim et al., 2005).

The introduction of direct acting antivirals (DAAs) like “Daclatasvir”, “Simeprevir” and “Sofosbuvir” against HCV is revolutionizing the field of HCV care as HAART did in 1996 with HIV, and therefore improving the prognosis of co-infection. However, due to their cost, DAAs are unavailable to the vast majority of patients in sub-Saharan African countries. Furthermore, whether available HCV therapeutics are equally efficacious on HCV strains circulating in sub-Sahara Africa has not been investigated. Therefore, affordable and widely accessible means to control and eradicate HCV infection worldwide are still needed. An important hallmark of HIV/HCV co-infection is that many people living with HIV in sub-Saharan Africa do not know their HCV status, since HCV screening tests are not yet as systematically performed as HIV screening tests, even in so-called “Reference Hospitals”. In addition, screening tests, when they do exist for HCV serology, are often based on rapid diagnostic tests, while immunoenzymatic ultra-tests are available for HIV health care, and directly integrated in the management policies.

In Cameroon, the plan to tackle HIV infection is well established: reduce the morbidity and mortality through the various prevention strategies of new infections, and the use of HAART organized in 1st, 2nd and 3rd lines of treatment provided to patients (Mbanya et al., 2008; Cameroon National AIDS Control Committee, 2010; Cameroon 2014 Country Operational Plan, 2014).

Conversely, the management plan for HCV infection is still in progress, without any written plan available to date (WHO, 2013). Research findings that provide policy makers with accurate support to improve the existing management policies are still sparse in Cameroon. Previous studies attempted to investigate the epidemiology of HCV infection either in sentinel surveillance conditions (e.g. pregnant women, maintenance haemodialysis, patients attending health facilities for care), or among first time blood donors (Halle et al., 2009; Noubiap et al., 2013; Noubiap et al., 2015; Luma et al., 2016a; Ankouane et al., 2016).

Very few studies have addressed and/or focused on the HIV/HCV co-infection and the impact on the disease progression. More accurate and reliable data among which co-infection sero-prevalence and risk factors studies, are still needed as prerequisite to the investigation of the disease progression in sub-Saharan Africa, vaccine and drug development strategies worldwide.

The aim of this study was to determine the sero-prevalence of HIV/HCV co-infection in various populations using the ultra immunoassay, as well as scrutinising the correlation with markers of liver function and CD4 count rate in Yaoundé, Cameroon.

METHODOLOGY

Study design, period and setting

The present study was a cross-sectional study based on biological and sociodemographic data. Information/sensitization and sample collection were done from November 2015 to February 2016, and between June TO October 2016 in three hospital settings in Yaoundé, Cameroon: Yaoundé Central Hospital, Yaoundé Military Hospital and “Clinique Bastos”.

Yaoundé Central Hospital

Yaoundé Central Hospital is a 381 bed tertiary level teaching hospital. The hospital employs about 800 staff including 95 doctors and about 270 nurses. The hospital provides surgical care, obstetrics, gynaecology and elderly care services along with radiology, intensive care, emergency services and an outpatient clinic to the population of the city and more widely across the country. The hospital is also a reference research and surveillance

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centre. It has an outpatient daily clinic for HIV/AIDS management.

Military Hospital

The military hospital in Cameroon's capital, Yaoundé, provides health care to Cameroonian and Chadian troops of the regional force, as well as to civil citizens. The hospital has a capacity of 200 beds. It is a treatment centre for HIV/AIDS, with laboratory equipped for HIV, HBV, HCV testing, confirmation and biochemical blood tests for patient's monitoring. The hospital receives the majority of HIV positive cases in the military, one of the key populations in Cameroon.

"Clinique Bastos"

"Clinique Bastos" is a private hospital for both in and out-patients care, with a capacity of about 25 beds. It mostly receives Cameroonians of the middle and upper economic classes. All the three hospital settings are authorized treatment facilities for people living with HIV/AIDS in Cameroon (PLHIV). It is important to mention that the majority of PLHIV in these health facilities, as in other health facilities in Cameroon do not know their status for HBV and/or HCV infection.

Target population/study participants

The study population consisted of patients attending the hospitals for consultation, and specialized centres within the aforementioned hospitals (for example, Day Care Hospital (where people living with HIV/AIDS are observed, and also receive health care) as well as Hepato-gastroenterology centre). HIV-positive patients were first recruited in Yaoundé Central Hospital, whereas another cohort of participants were further enrolled and screened for hepatitis C virus in the three health facilities. According to the Demographic and Health Survey and Multiple Indicators Cluster Survey (DHS-MICS), the HIV seroprevalence in Cameroon is higher (4.3%) compared to the HCV seroprevalence, 1.03% in the general population. Therefore, a high sample size should be considered while screening the general population for HCV infection.

Study inclusion criteria

Participants in the present study were those who had never been screened for HCV infection. Participants were fairly selected irrespective of gender, ethnicity, tribe, or religious belief. Enrolled participants were patients who agreed to sign a consent form after being informed of the nature of the study, the potential benefits and minimal foreseeable risks associated with the sample collection, as well as the voluntary nature of the participation.

Data collection procedure and analyses

Socio-demographic information and other relevant possible risk factors for the study participants (age, marital status, level of education, occupation) were collected using a questionnaire with both closed and open questions. About 4 mL of venous blood was collected by venous puncture in tube with EDTA. Blood specimens were centrifuged at 1,500 rpm for 5 minutes; 1mL plasma aliquots were made and separately stored at -20°C and -80°C for subsequent analyses (a total of 2 aliquots per sample). An aliquot (plasma) stored at -20°C was used for the HCV screening test.

Principle of detection of HCV infection

All plasma samples (from PLHIV and the other cohort of participants) were screened for HCV using Monolisa HCV Ag-Ab ULTRA assay (BioRad, France). Monolisa HCV Ag-Ab ULTRA assay is an enzyme immunoassay for the detection of HCV infection, based on the detection of capsid antigen and antibodies associated with an infection by Hepatitis C virus in patient serum or plasma. The microplate solid phase is coated with monoclonal antibodies against capsid protein of Hepatitis C virus, two recombinant proteins produced by E. coli from NS3 region: genotype 1 and 3a, one recombinant antigen from the non-structural region NS4, and a mutated peptide from the capsid of structural area of the hepatitis C virus genome. The conjugates used are: mouse biotinylated monoclonal antibodies against the hepatitis C capsid that do not react against the hepatitis C capsid mutated peptide coated on the microplate; mouse peroxidase-labelled antibodies to human IgG and peroxidase-labelled streptavidin.

Biochemical parameters

Biochemical markers of liver function (serum activity of alanine aminotransferase (ALT), aspartate aminotransferase (AST), Alkaline phosphatase (ALP), and serum concentration of conjugated bilirubin), as well as CD4 T-cells count were collected and analyzed.

Data preparation, management and analysis

The effect size for this study was computed using G*Power version 3.1.9.2 software, with post-hoc power analysis. Data obtained were subsequently entered, cleaned and analyzed using the Statistical Package for Social Sciences (SPSS) software (version 22.1). Mean, frequencies and percentages were used to summarize descriptive statistics of the data. Chi-square (X2) test was used to assess relationships between selected and/or qualitative variables namely gender, sex, marital status, level of education and occupation. Pearson correlation was used to determine the relationship between the biochemical parameters and CD4 cells count. The significant difference was set at the threshold $p \leq 0.05$.

RESULTS

The effect size for this study was computed using G*Power version 3.1.9.2 software (Faul et al., 2007; Faul et al., 2009), with post-hoc as type of power analysis. The sample size (N=75) was in conformity with the effect size, 0.3 with X2 test, and 0.6 with the Pearson correlation. In the present study, 75 newly diagnosed people with HIV (PLHIV) in Yaoundé Central Hospital, as well as a cohort of 546 patients attending Yaoundé Central hospital, Military Hospital and Clinique Bastos were enrolled.

Sex and age variables

Out of 75 PLHIV enrolled, 54 (72%) were women and 21 (28%) were men (Table 1), whereas among the 56 HCV infected people from the cohort of 546 individuals, 12 (21.43%) were female and 44 (78.57%) were male (Table

Table 1. Distribution of the 75 people living with HIV in Yaoundé Central Hospital within age groups and sex (November 2015 to February 2016).

Age group (years)	Female (%)	Male (%)	Total (%)
21 – 30	5 (6.7)	1 (1.3)	6 (8.0)
31 – 40	6 (8.0)	1 (1.3)	7 (9.3)
41 – 50	12 (16.0)	7 (9.3)	19 (25.3)
>50	31 (41.3)	12 (16.0)	43 (57.3)
Total	54 (72.0)	21(28.0)	75 (100)
Mean age	50.41±11.67	52.38±10.24	50.96±11.26

Table 2. Distribution of individuals tested HCV positive among 546 participants in the three health facilities in Yaoundé (June to October 2016).

Health facility	Total tested	Total tested positive (%)	Prevalence (%)	Female (%)	Male (%)
Yaoundé Central hospital	297	33 (58.93)	11.11	7.14	51.79
Yaoundé Military hospital	162	17 (30.36)	10.49	10.71	19.64
Clinique Bastos	87	6 (10.71)	6.9	3.57	7.14
Total	546	56 (100)	10.26	21.43	78.57

3). Women were therefore the most affected by HIV infection according to this study, while men were mostly affected by HCV infection. The mean age was 50.96±11.26 years with 57.3% of people aged over 50 years in PLHIV, compared to a mean age of 36.40±16.77 years in people with HCV. Mean age among HIV/HCV co-infected individuals was higher in the two populations, 58.4±5.32 years and 54.6± 11.55 years respectively for the first and second cohorts, compared to HIV mono-infected people, 50.96±11.26. Also, Mean age in HIV/HCV co-infected men in the two populations (59.00±1 and 63.5±7.78 years respectively) was higher than the mean age in women (58.14±6.47 and 48.66±10.21 years). In total, 93.33% of HIV/HCV co-infected individuals were aged 50 years and above.

Seroprevalence of HIV/HCV co-infection and socio-demographic characteristics

Amongst the 75 HIV-positive patients, ten were also infected by HCV, giving the seroprevalence of 13.3% for HIV/HCV co-infection. Out of 56 HCV positive patients from the cohort of 546 people, five (5) were confirmed HIV positive. The seroprevalence of HCV infection was 10.26% among 546 enrolled participants, and 13.33% in 75 PLHIV (Tables 2 and 4). In the Tables 4 and 5, it is noticeable that the HIV/HCV co-infection seroprevalence is 13.3% in PLHIV but 8.93% among people with HCV infection. HIV/HCV co-infected women were numerous inPLHIV (seven women out of ten patients) as well as in secondary level of education, and civil servants were numerous among HIV/HCV co-infected individual (Table 4). In the population of HCV infected individuals, married people, people with secondary level of education and unemployed were more numerous among the co-infected (Table 5). the other cohort (three out of five), for a total of ten women out of 15 HIV/HCV co-infected individuals, 66.67%. In PLHIV, married people, widowed, people with secondary level of education, and civil servants were numerous among HIV/HCV co-infected individual (Table 4). In the population of HCV infected individuals, married people, people with secondary level of education and unemployed were more numerous among the co-infected (Table 5).

CD4 count analysis

The mean CD4 T-cells in HIV mono-infected and HIV/HCV co-infected patients were 413.68±192.49 cells/ mm^3 and 369.90±235.03 cells/mm^3 respectively. However, the difference was not statically significant. In HIV mono-infected, minimum value obtained was 15 cells/mm^3 and the maximum value was 929 cells/mm^3 whereas in HIV/HCV co-infected, the results show 47 cells/mm^3 and 728 cells/mm^3 respectively for minimum and maximum values (Table 6).

Correlation between different parameters and disease stage

Biochemical parameters (activity of alanine amino-transferase (ALT), aspartate amino-transferase (AST), alkaline phosphatase (ALP), gamma glutamyl-transferase (ɣ-GT), and serum concentration of conjugated bilirubin

Table 3. Distribution of the 56 individuals tested HCV positive within age groups and sex (June to October 2016).

Age group (year)	Female (%)	Male (%)	Total (%)
19 – 30	6 (10.71)	25 (44.64)	31 (55.37)
31 – 40	1 (1.79)	7 (12.50)	8 (14.29)
41 – 50	0 (0)	2 (3.57)	2 (3.57)
>50	5 (8.93)	10 (17.86)	15 (26.79)
Mean age	40.25±19.76 (21-69)	35.65±15.82 (19-77)	36.40±16.77 (19-77)
Total	12 (21.43%)	44 (78.57%)	56 (100%)

Table 4. Socio-demographic characteristics among HIV mono-infected and HIV/HCV co-infected patients in Yaoundé Central Hospital (November 2015 to February 2016).

Sex	Group		
	HIV mono-infected (%)	HIV/HCV co-infected (%)	Total HIV infected (%)
Male	18 (24.0)	3 (4.0)	21 (28)
Female	47 (62.7)	7 (9.3)	54 (72)
Total	65 (86.7)	10 (13.3)	75 (100)
Marital status			
Unmarried	19(25.3)	2 (2.7)	21 (28.0)
Divorced	5 (6.7)	2 (2.7)	7 (9.4)
Married	19 (25.3)	3 (4.0)	22 (29.3)
Widowed	22 (29.3)	3 (4.0)	25 (33.3)
Total	65 (86.7)	10 (13.3)	75 (100)
Education			
Unschooled		0 (0)	4 (5.3)
Primary	26 (34.7)	4 (5.3)	30 (40.0)
Secondary	28 (37.3)	6 (8.0)	34 (45.3)
Higher	7 (9.3)	0 (0)	7 (9.3)
Total	65 (86.7)	10 (13.3)	75 (100)
Occupation			
Civil servants	9 (12.0)	4 (5.3)	13 (17.3)
Other workers	37 (49.3)	3 (4.0)	40 (53.3)
Unemployed	19 (25.3)	3 (4.0)	22 (29.3)
Total	65 (86.7)	10 (13.3)	75 (100)

(CB) were analysed by means of the correlation coefficient “r”. Bivariate correlations between these parameters were searched, in HIV mono-infected as well as in HIV/HCV co-infected patients. Pearson correlation analysis showed a negative and significant correlation between CD4 T cells count and ALT activity (r = -0.241 P = 0.049), and between CD4 cells count and conjugated bilirubin (r = -0.278 P = 0.023) at the threshold 0.05 in HIV mono-infected (Table 7). In HIV/HCV co-infected patients, a positive and significant correlation was observed between ALT and AST activities (r = 0.745 P = 0.013), γ-GT and ALT activities (r = 0.652 P = 0.041), and between total and conjugated bilirubin (r = 0.988, P□0,001) (Table 8).

DISCUSSION

The sampling results showed that among PLHIV recruited, women were the most affected whereas men were the most HCV infected. Actually, women are biologically more vulnerable than men since the mucous

Table 5. Socio-demographic characteristics among HCV mono-infected and HIV/HCV co-infected patients in the three health facilities (June to October 2016).

Characteristics	HCV Mono-infected (%)	HIV/HCV Co-infected (%)	Total (%)
Sex			
Male	42 (80.35)	2 (3.57 %)	44 (78.57 %)
Female	9 (16.07)	3 (5.35 %)	12 (21.42 %)
Total	51 (91.07)	5 (8.93 %)	56 (100 %)
Marital status			
Single	34 (60.71)	1 (1.78)	35 (62.5)
Married	15 (26.78)	3 (5.35)	18 (32.14)
Widowed	2 (3.57)	1 (1.78)	3 (5.35)
Total	51 (91.07)	5 (8.93)	56 (100)
Level of education			
Unschooled	2 (3.57)	2 (3.57)	2 (3.57)
Primary	6 (10.71)	1 (1.78)	7 (12.5)
Secondary	25 (44.64)	4 (7.14)	29 (51.78)
Higher	18 (32.14)	0 (0)	18 (32.14)
Total	51 (91.07)	5 (8.93)	56 (100)
Occupation			
Civil servants	15 (26.78)	1 (1.78)	16 (28.57)
Other workers	8 (14.28)	2 (3.57)	10 (17.85)
Unemployed	28 (50)	2 (3.57)	30 (53.57)
Total	51 (91.07)	5 (8.93)	56 (100)

Table 6. CD4 T cells count and association with HIV mono-infection and HIV/HCV co-infection.

Type of infections	HIV mono-infection	HIV/HCV Co-infection	p-value
Mean CD4 T cells (cells/mm^3)	413.68±192.49	369.90±235.03	0.515
Minimum CD4 T cells (cells/mm^3)	15	47	-
Maximum CD4 T cells (cells/mm^3)	929	728	-

Table 7. Correlation between CD4 count and biochemical parameters among HIV mono-infected patients (N=65).

Variable		Enzyme activity			Serum concentration
		AST	ALT	ɣ-GT	CB
CD4	R	-0.229	-0.241**	0.163	-0.278**
Count	p-value	0.063	0.049	0.187	0.023

surface exposed to HIV during the non-protected sexual relation is larger (Nebout, 1994). Also, the virus attains the high concentrations in the sperm compared to the vaginal secretion, and the HIV transmission frequency in the heterosexual intercourse is most likely to be higher from men to women. In addition, Cameroonian women are more likely to undergo relationship with men older than them, some of whom might have encountered multiple other women partners in their sexual activity history. In short, a multitude of factors increase women's vulnerability to HIV acquirement, including biological, behavioral, socio-economic, cultural and structural risks (Mabala, 2006; Ramjee and Daniels, 2013). Concerning the HCV infection, it is well known worldwide that HCV is

Table 8. Correlation between biochemical parameters in HIV/HCV co-infected patients.

Variable		AST	ALT
ALT	p-value	**0.745****	-
		0.013	-
γ-TG	R	-	0.652**
	p-value	-	0.041

a blood-born pathogen with low sexual transmission rate compared to HIV and hepatitis B virus infections. In Cameroon, a possibility of iatrogenic transmission during the early 20th century has even been hypothesized in a previous study (Pepin et al., 2010), and another study mentioned the HCV infection as a cohort effect (Nerrienet et al., 2005).

With the current study, up to 78.57% men were identified HCV positive, though HIV/HCV co-infected women were still higher in the population of co-infected individuals. This might be due to the fact that in Cameroon, men are less likely to solicited regular medical check-up compared to women. Furthermore, sentinel surveillance in force in Cameroon more than two decades ago has revolutionized the mother and child health care through the prevention of mother-to-child transmission (PMCT) programme. The policy of this programme implies that each and every pregnant woman attending any health facility in Cameroon is systematically screened for HIV, syphilis and hopefully in the near future, hepatitis B and C infections (written strategic plan not yet available).

The project for hepatitis management plan has been initiated in Cameroon in 2015, following the world health organisations (WHO) Global policy report on the prevention and control of viral hepatitis, 2013. It appears in WHO Global policy report that to the question « Is there a written national strategy or plan that focuses exclusively or primarily on the prevention and control of viral hepatitis? », the response concerning Cameroon was « No » (WHO, 2013). Four years into the remarks, the (written) policies are still in progress.

The seroprevalence of HIV/HCV co-infection was documented in this study: 13.3% in PLHIV and 8.92% in HCV patients, whereas 10.25% were detected HCV positive among 546 individuals. These seroprevalence rates are significantly higher and therefore in discordance with results obtained by previous researchers in hospital settings in Cameroon, as far as HCV infection is concerned (Noubiap et al., 2013; Noubiap et al., 2015; Luma et al., 2016b). This might be in part due to the robustness of the screening test. Previous studies mostly used rapid diagnostic test based on immune-chromatographic principle, or immunoassay detecting antibodies against HCV.

In the presence study, the ultra immunoenzymatic assay for the detection of HCV core antigen and anti-HCV antibodies was used. It has been shown that simoultanous detection of HCV capside antigen and the various antibodies enhances the early detection of HCV infection (Laperche et al., 2005; Tagny et al., 2014). In these studies, the sensitivity and reliability of the assay were well described. Refering to findings in the present study and to the national sero-prevalence for HCV infection in Cameroon in the general poulation, one might affirm that people with HIV are more at risk for HCV infection.

It is well noticeable in the present study that HIV/HCV co-infected as well as HCV mono-infected patients are older, up to 93.3% people aged 50 years and above. Therefore, age appears to be a risk factor. This corroborates findings from other settings: in a study conducted in Central Brazil, increasing age was a risk factor for both HCV and HIV-1 infection among pregnant women (Costa et al., 2009). These results also confirm previous studies on hepatitis viruses' trends conducted in Cameroon, in a secondary used of historical blood samples collected in 2009 during the Demographic and Health Survey and Multiple Indicators Cluster Survey (DHS-MICS), to determine the seroprevalence of hepatitis B, C and Delta infections. Data analysis indicates that in Cameroon, HCV infection in the general population account for about 1.03%, but is higher in the elder populations: HCV seroprevalence varies from 1% in people under 45 years of age, to 3% between 45-55 years and 7% in people above 55 years respectively (Njouom and Tejiokem, 2016).

Analysing the CD4 T cells count, it was subject to variation in co-infected individuals without any significant difference in mean CD4 count between HIV mono-infected and HIV/HCV co-infected participants (p=0.515): patients with HIV/HCV co-infection had a low mean CD4 T-cells count together with a high standard deviation, 369.90±235.03 cells/mm3compared to mean CD4 T-cells count and standard deviation in HIV mono-infected participants, 413.68±192.49. In addition, the analysis of the minimum and the maximum CD4 T-cells count values in the two groups shows that the lowest CD4 count value was observed in the HIV mono-infected groups, but a low maximum value observed in HIV/HCV co-infected patients. This magnitude of CD4 T-cells count in HIV/HCV co-infected could be due to the pressure by the two viruses on the human organism. This might be attributed to reduced immunity (immune suppression) in HIV positive patients leading to vulnerability to other opportunistic infections. This study ends-up by the following observation: two (2) in every 15 people with HIV are HIV/HCV co-infected.

The negative and significant correlation observed between CD4 T-cells count and ALT, CD4 count and conjugated bilirubin in HIV mono-infected patients proves

that CD4 T-cells decrease, enabling progression of AIDS, while ALT and conjugated bilirubin increase, sign of liver deterioration. In HIV/HCV co-infected patients, ALT activity increases with AST and γ-GT activities, and this is an indicator of liver deteriorating liver function in these populations.

Conclusions

Hepatitis C virus infection is a threat in people living with HIV in Cameroon: the seroprevalence of HCV infection is significantly higher amongst HIV positive patients than in the general population in Cameroon. Women are more at risk with a high HIV seroprevalence rate. Age tends to be a risk factor. Also, correlation investigation indicates that when biochemical parameters of the liver function are elevated, the immuno-depression is observed. It is important and urgent that disease awareness is implemented in health facilities, that written national strategic plans that focuses exclusively on the prevention and control of viral hepatitis and co-infections are not only set up, but be functional. Follow-up of people living with HIV shall include the identification of acute and chronic HCV carriers; future investigation of HCV persistence and infectivity of representative isolates from around the world might be useful worldwide in improving widely accessible drugs and vaccine development.

RECOMMENDATIONS

Based on the present research findings, a national management and active surveillance program for HIV and hepatitis co-infections is essential in the country, as a critical step to reduce the incidence and morbidity rates of these affections. The new policies shall integrate and consider viral hepatitis as serious as HIV infection. In addition, the screening algorithms should integrate rapid diagnostic tests as well as enzyme-immunoassays.

ETHICAL APPROVAL AND CONSENT TO PARTICIPATE

The present study satisfied the national and international ethical standards: Ethical clearance was obtained from the Cameroon National Research Ethics Committee for Human Health, prior to the study implementation (Authorizations N°2015/11/664/CNERSH/SP and N°2016/06/779/CNERSH/SP). In addition, informed consent was obtained from each enrolled participant. The study was conducted according to the CIOMS guidelines, and complied with the Declaration of Helsinki, 2015. Participants gave their authorization that samples are transferred for future investigations from Cameroon to United States under safety conditions, together with CDC permit and a duly executed MTA between the providing and the recipient institutions.

CONFLICT OF INTERESTS

The authors have not declared any conflict of interests.

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