Original Research Article

Seroprevalence of HIV with Hepatitis B and C Co-infection in Patients at the Al Nadjma Multi-purpose Center Laboratory in N'Djamena, Chad

ABSTRACT

Co-infection with hepatitis B and C is one of the major challenges in the management of HIV since access to antiretroviral drugs has improved in Africa. The aim of this study was to determine the seroprevalence HIV/Hep B and C co-infection in patients treated at the Al Nadjma multi-purpose centre in N'Djamena, Chad. This prospective study was conducted from June 2023 to May 2024 on 3,430 patients seen at the laboratory of the Al Nadjma multi-purpose Center in N'Djamena for screening for both HIV and hepatitis B and C. HIV was detected by immuno-chromatography using specific kits. The detection of hepatitis B and C by detection of HBsAg and HCV AC was carried out by immunochromatography using specific kits.The mean age of the patients was 38 years, with extremes of 18 and 60 years. Males were predominant (71.2%), with a sex ratio (M/F) of 1.22. The most common age was 31 to 40 (38.48%). The prevalence of HIV, hepatitis B and hepatitis C was 4.84%, 4.46% and 0.93% respectively. The prevalence of HIV/HBV, HIV/HCV and HIV/HBV/HCV co-infections was 4.17%, 0.79% and 0.09% respectively. This study shows that HIV and hepatitis B seroprevalence are high in N'Djamena. On the other hand, hepatitis C virus and HIV/HCV and HIV/HBV/HCV co-infections are relatively low compared with most of the data reported in other Sub-Saharan African countries. However, HIV/HBV co-infection could be considered a public health problem, requiring early diagnosis by organizing awareness and screening campaigns in the population, thus enabling better management of co-infected patients (HIV/HBV) by dual antiretroviral and anti-hepatitis B treatment.

Keywords: Seroprevalence, Co-infection, HIV, HBsAg (HBV), HCV, N'Djamena, Chad.

1. INTRODUCTION

The pandemic of infection by the Human Immunodeficiency Virus (HIV) is far from being under control, despite the major interventions carried out worldwide [1]. Access to antiretroviral treatment in sub-Saharan Africa remains very poor, due to obstacles such as the limited number of doctors, limited viral load testing, and problems with the availability of simpler tests such as CD4 T-cell or biochemistry tests [2-5]. Despite this, HIV, with its virulence, is not the only health threat. There are also other viruses whose expansion and evolution are worrying, notably the hepatitis B virus (HBV) and the hepatitis C virus (HCV), which are also major public health problems. A silent killer, viral hepatitis is a global public health problem, causing more than 1.4 million deaths each year worldwide [6]. Hepatitis B and C are the two main forms of viral hepatitis, causing liver damage and sometimes fatal cancer.

It is estimated that around two billion people worldwide are infected with the hepatitis B virus, of whom more than 350 million have chronic liver disease. Between 500,000 and 700,000 people die from hepatitis B every year [7]. These deaths are mainly due to complications of chronic hepatitis, namely cirrhosis and primary liver cancer [8]. Some 130 to 170 million people are chronic carriers of hepatitis C, and it estimated that more than 350,000 people die each year from hepatitis C-related liver [7]. What's more, from a therapeutic point of view, both hepatotropic viruses require extensive treatment, which is often poorly tolerated and often leads to complications making prevention the only effective means of combating the disease [7,9]. Co-infection with the human immunodeficiency virus (HIV) and the hepatitis B and C viruses is common and constitutes a major public health problem worldwide. HIV infection alters the natural history of HBV and worsens the prognosis chronic hepatitis B [10-13]. HIV infection increases the HCV viral load by a factor of 2 to 8, leading on the one hand to an increased risk of maternal-foetal transmission (from 3 to 20%) and sexual transmission (from 0 to 3%) of HCV compared with HCV monoinfection, and on the other hand to a reduction in spontaneous recovery from acute hepatitis C [14].

The viruses responsible for these diseases share the same modes of transmission: sexual, blood transfusion, injection drug use [15-18]. HIV infection worsens the prognosis of liver disease associated with hepatitis C virus and hepatitis B virus [19].

Sub-Saharan Africa remains the part of the world most affected by this pandemic, with the HIV infection rate study indicating that the virus is still the most frequent cause of death in sub-Saharan Africa, despite the rapid development of antiretroviral therapy [20]. The 2013 UNAIDS report estimates that 4 to 5 million people living with HIV/AIDS are co-infected with the hepatitis C virus and more than 3 million with the hepatitis B virus.

In Chad, the figures, while still fragmentary and limited, are still alarming. According to recent data from the World Health Organisation, the country is one of the high-prevalence areas for hepatitis, with a prevalence of hepatitis B of around 19% in the population. Among women attending antenatal clinics, it is around 4.6%, seroprevalence of the hepatitis C virus is around 2.5% [6].

The main gap that needs to be filled is the low coverage of screening and treatment to achieve the global goals of eliminating hepatitis by 2030 [6].

The objective of this study is to determine the seroprevalence of HIV/Hepatitis B and C co-infection in patients admitted to the Al Nadjma multi-purpose Center in N'Djamena, Chad.

2. MATERIAL AND METHODS

This is a prospective study lasting 12 months, from June 2023 to May 2024, carried out in the laboratory of the Al Nadjma multi-purpose Center, which is a national reference Center for the care of people living with HIV/AIDS and viral hepatitis. The study population of male and female patients over 18 years of age who were seen at the laboratory of the Al Nadjma multi-purpose Center in N'Djamena for screening for both HIV and hepatitis B and C. Patients agreed to participate in this study without coercion. We used exhaustive empirical sampling. Our data were collected using a pre-established survey questionnaire.

This questionnaire was used to collect the socio-demographic data of the patients surveyed (age, sex, profession, level of education, place of residence, family situation), as well as biological data (results of screening for HIV, hepatitis B and hepatitis C). Venous blood taken from all in a collection tube containing anticoagulants, to test plasma or serum for HIV, HBV and HCV. Testing for hepatitis B and C by detection of HBsAg and HCV AC was carried out

by immunochromatography specific kits (Cypress HBsAg Dipstick and HumanHexagon HBsAg and ACHCV).

For HIV diagnosis: HIV testing was performed by immunochromatography using *HIV Determine* kits, followed by confirmation typing (HIV-1/2 3.0 Bioline, Standard Diagnostics, INC, Republic of Korea). Confirmation was performed by ELISA using the mini-Vidas automated system, in accordance with the manufacturer's recommendations (bio-Mérieux, Marnes La Coquette, France). After collecting and labeling whole blood in an anticoagulant tube or dry tube, it should be centrifuged for 5 minutes in the centrifuge. After centrifugation, 50 microliters of serum or plasma are collected using a pipette and placed on the well of the strip and wait for 15 minutes and read. The SD Bioline HIV1/2 test is a confirmatory test for HIV1/2. To perform this test, it is important to bring the samples to room temperature between 15 and 30 °C. The test device is then removed from the aluminum foil pouch and placed on a flat, dry surface. A label with the patient identifier is affixed to the test device. Using a precision micropipette, 20 to 50 microliters of plasma or serum or 20 microliters of whole blood are collected and placed in the "S" sample well, then 4 drops of assay diluent are added to the "S" sample well and the test result is waited for 10 to 20 minutes after the assay diluent is added to the strip. The chembio HIV ½ STAT-PAK test is also a confirmatory test. After removing the device from the box of this test from its pouch and bringing it to room temperature, then placing it on a flat surface. A label with the patient's name or identification number is affixed to the device and the 5 microliter sampling loop is brought into contact with the specimen, allowing its opening to fill with liquid. The sample loop is held upright and the buffer is brought into contact with the center of the specimen well (S) of the device to deposit 5 microliters of a sample (serum, plasma, or whole blood). The transport buffer vial is then inverted and 3 drops of the buffer solution are slowly added to the SPECIMEN well (S). The test result is then read 15 minutes after the transport buffer solution is added.In some cases, a test line may appear in less than 15 minutes; however, it takes 15 minutes to report a non-reactive test result. The test results are then read in a bright area.

For the diagnosis of HBV: The procedure of the test determines HBsAg of whole blood samples, collected by venipuncture, is done after centrifugation of plasma or serum samples. 50 microliters of the serum or plasma sample are taken using a precision pipette and deposited on the sample deposit area and wait one minute for the sample to be absorbed, then add a drop of migration buffer on the sample deposit area, holding the bottle upright; after adding the buffer solution and wait 15 to 30 minutes and read the result.For whole blood samples collected from the fingertip using capillary tubes with EDTA, place the capillary tube containing the whole blood sample in the center of the sample deposit area in an upright position and wait until all the blood has transferred from the capillary tube to the sample deposit area. Then immediately place a drop of running buffer on the deposit area, holding the vial upright, and wait 15 to 30 minutes to read the test result.

For HCV diagnosis: The procedure for the HCV determination test for whole blood samples, collected by venipuncture, is done after centrifugation of the blood samples (plasma or serum). 50 microliters of the serum or plasma sample are taken using a precision pipette and deposited on the sample deposit area and wait one minute for the sample to be absorbed. The test diluent vial is held upright and 4 drops of running buffer are deposited on the sample deposit area "S", after adding the buffer solution and waiting at least 15 to 30 minutes to read the result. For fingerstick whole blood samples, 10 microliters of whole blood sample are collected using a precision micropipette and the 10 microliters of whole blood sample are dispensed into the “S” sample well while holding the test diluent vial upright. Immediately place 4 drops of this solution into the “S” sample well and read the test result 15 to 30 minutes after the transport buffer solution is added.

The data were analyzed using Excel 2017 software. Anonymity was ensured by using the patient's registration. This study was conducted in compliance with ethical rules and the Helsinki agreement. Patient consent was required.

3. RESULTS AND DISCUSSION

3.1 Sociodemographic characteristics

In total, the sample consisted of 3430 patients received at the laboratory of the Al Nadjma multi-purpose centre in N'Djamena for screening for HIV, hepatitis B and hepatitis C. The sample was predominantly male, with 55.01% of participants, giving a sex ratio (M/F) of 1.22 men to 1 woman (Figure 1).

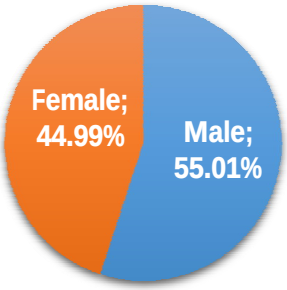

Fig. 1. Distribution of co-infections by sex

The mean age of the participants was 38 years with extremes of 18 and 60 years. The most represented age group was that of patients aged 31 to 40 years with 38.48% of patients, followed by those of 25 to 30 years and 18 to 24 years with 24.87% and 17.17% of patients respectively (Figure 2). It should be noted that in our study there is no co-infection in the age group of 61 years and older.

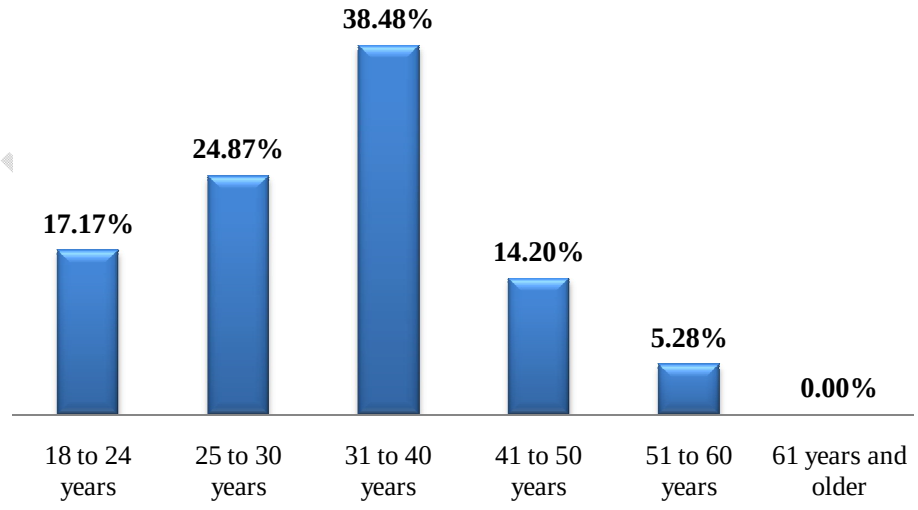

Fig. 2. Distribution of co-infections by level of education

According to the level of education, patients with higher education constituted the dominant class with 28.63% followed by those with secondary and primary education with 26.71% and 23.73% respectively each (Table 1). Those with no level of education represented 20.93% of the patients.

Table 1. Distribution of co-infections by level of education

Variable	Number of Patients (3430)	Percentage (%)
None	718	20.93%
Primary	814	23.73%
Secondary	916	26.71%
Superior	982	28.63%

The results according to the marital status of the participants showed that 50.87% of our patients are married, 28.28% and 12.42% of the patients are single and divorced respectively while only 8.28% of them are widowed.

Table 2: Distribution of co-infection according to marital status

Variable	Number of Patients (3430)	Percentage (%)
Single	970	28.28%
Married	1745	50.87%
Divorced	426	12.42%
Widowed	289	8.43%

3.2 Prevalence of HIV, HBV, HCV and HIV/HBV/HCV co-infection

Overall prevalence of HIV infection was 4.84% for all patients screened in this study. The prevalences of hepatitis B and C were 4.26% and 0.93% respectively, while those of HIV/HBV, HIV/HCV and HIV/HBV/HCV co-infections were 4.17%, 0.79% and 0.09% respectively (Table 3).

Table 3: Prevalence of HIV, HBV, HCV and Co-infections

Variables		Number of Patients (3430)	Percentages (%)
HIV	Positive	166	4.84%
	Negative	3264	95.16%
AgHbs	Positive	146	4.26%
	Negative	3284	95.74%
AcHcv	Positive	32	0.93%
	Negative	3398	99.07%
HIV/AgHBs	Positive	143	4.17%
	Negative	3287	95.83%
HIV/AcHcv	Positive	27	0.79%

	Negative	3403	99.21%
HIV/AgHBs/AcHcv	Positive	3	0.09%
	Negative	3427	99.91%

3.3 Discussion

Our results showed that male subjects included in the study were the most numerous (55.01%), with a sex ratio (M/F) equal to 1.22. The same dominance of men was found in a study conducted at the Sino-Guinean Friendship Hospital in Conakry (Guinea) where the authors found 71.2% of men, with a sex ratio (M/F) equal to 2.47. These results are diametrically opposed to those reported in Botswana and Ghana where the authors worked respectively on a population of 118 patients with 67.8% female (sex ratio M/F = 0.67) and 320 participants including 72.5% female (sex ratio M/F = (0.37) [21,22]. The male predominance in our study could be explained by their attendance at this hospital center.

The mean age of our patients, which was 38 years, is close to the value of 37 years found in Guinea [21], of 35 years found in Botswana [22] and 40 years reported in Ghana [23]. The most represented age group was 31 to 40 years with 38.48% of respondents. This value is comparable to that of Makanera and al, in 2019 where the cumulative total of the two age groups of 25 to 29 years and 30 to 34 years is equivalent to 38.5% [21] and to that of 37.2% reported in 2016 in Ghana by Kye-Duodu and al, whose most represented age group was 31-40 years old [23].

But this value remains lower than the results reported in Botswana which were 46.39% for the 30-39 age group [22]. The representativeness of the 31 to 40 age groups could be explained by the intense sexual activity and youth of this population. Married patients represented the majority of patients surveyed (50.87%). This category of marital status seems to be much more exposed.

The overall seroprevalence of HIV infection was 4.84% for all patients screened. This result is low compared to that reported by many studies conducted on HIV in sub-Saharan Africa such as those observed in 2019, 2016 and 2015 in Guinea, Nigeria and Cameroon respectively [21, 24, 25]. In Zambia, the authors reported an HIV infection rate of 9.9% [26] and in Cameroon, the prevalence of HIV infection was 6.0% [1]. Sexually transmitted infections (STIs) play a role in the sexual transmission of HIV [27,28].

The prevalence of hepatitis B virus (HBV) in our study was 4.26%. It was comparable to that reported in the city of Bafoussam by [1]. The prevalence of hepatitis B virus in this city was 4.1%.

The rate of 4.26% is significantly lower than that found in Guinea (17.9%) [21] and Nigeria (47.5%) [24]. It is also lower than that of the sub-Saharan region of Africa where the hepatitis B virus carriage rate varies from 5 to 20% [29,30]. The seroprevalence of 4.26% for hepatitis B in the present study is a moderate seroprevalence according to the WHO classification criteria. The WHO considers HBV seroprevalence to be low if it is less than 2%, moderate if it is between 2% and 8%, and high if it is than 8% [28, 31].

The prevalence of HIV and hepatitis B co-infection in the present study was 4.17%. This prevalence is higher than 2.3% reported in Guinea by [21]. On the other hand, this prevalence is lower than 5.1% reported in Botswana [22] and 16.9% in Benin at the Parakou University Hospital [32]. Similarly, the prevalence observed in this study is lower than those reported in Kenya which is 6% and 5.7% [29, 33]. This prevalence is also lower than 8.8%

reported in Tanzania and 20.4% observed in Malawi [34]. As for the hepatitis C virus (HCV), its prevalence was 0.93%, slightly higher than the study by Francois-Xavier Mbopi-Keou and al., who reported a prevalence of 0.4% [1].

4. CONCLUSION

HIV, hepatitis B and HIV/HBV co-infection were more frequently observed. The observed seroprevalences of HIV, hepatitis B and HIV /HBV co-infection suggests that these viral diseases are a significant public health problem in Chad. These seroprevalences call on health authorities to organize, on the one hand, awareness campaigns for the population to change behavior by applying measures to prevent sexually transmitted infections, and on the other hand, HBV and HIV screening campaigns in the population, as well as screening for the hepatitis B virus in all HIV-positive patients. Finally, treat HIV/HBV co -infected patients with antiretroviral and anti-hepatitis B molecules.

Ethical Approval:

As per international standards or university standards written ethical approval has been collected and preserved by the author(s).

Consent

As per international standards or university standards, patient(s) written consent has been collected and preserved by the author(s).

Disclaimer (Artificial Intelligence)

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc.) and text-to-image generators have been used during the writing or editing of this manuscript.

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