Int.J.Curr.Microbiol.App.Sci (2022) *11*(11): 134-140

International Journal of Current Microbiology and Applied Sciences
ISSN: 2319-7706 **Volume 11 Number 11 (2022)**
Journal homepage: http://www.ijcmas.com

Original Research Article https://doi.org/10.20546/ijcmas.2022.1111.017

Prevalence of HIV in Patients with Pulmonary Tuberculosis in the City of Bongor in Chad

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Keywords

Prevalence, TB, HIV, Bongor, Chad, ill health, HIV-infected patients

Article Info

Received:
04 October 2022
Accepted:
28 October 2022
Available Online:
10 November 2022

A B S T R A C T

TB/HIV co-infection is a public health problem in countries with limited resources. The objective of this work was to determine the prevalence of TB/HIV co-infection and to assess the level of contamination of patients screened in each district of the city of Bongor. A prospective cohort study took place from January 2019 to December 2021, in the Department of Phtisiology and the laboratory of the Provincial Hospital of Bongor, including patient files from the 17 districts of the city of Bongor. Ziehl-Neelsen staining and the GeneXpert automaton were used to process and analyze the patients sputum and blood. Epi Info 7™ software facilitated statistical analyses. A total of 320 patients were included in this study. In this study obtained 56.25% of positive sputum and 20.31% of seropositive patients. TB/HIV co-infection was found in 17.19% of seropositive patients. The most co-infected age group was between 32–38, representing 32.73% of patients. TB/HIV co-infected patients by neighborhood represented 0.41% of the inhabitants. The most affected neighborhood was Djoh-Bongor with 0.068%. Conclusion: TB/HIV co-infection in the city of Bongor affects 11 neighborhoods out of 17. The State must provide resources for more awareness-raising in order to stop contamination.

Introduction

Tuberculosis, a communicable disease, is a major cause of ill health, one of the top 10 causes of death worldwide (Global tuberculosis report, 2020). In the 1980s, with the advent of HIV, there was an emergence of tuberculosis as an opportunistic disease associated with AIDS. Tuberculosis, on the other hand, increases viral replication in HIV-infected people and accelerates disease progression (Assiya *et al.*, 2018). Tuberculosis and HIV are major public health problems in many parts of the

world, especially in countries with limited resources. Tuberculosis is the most common cause of death in HIV-infected patients (Bekele *et al.,* 2018).

According to World Health Organization estimates in 2021, globally, the number of deaths from tuberculosis among HIV-positive people is 214,000 (Global tuberculosis report, 2021). In the African Region of the World Health Organization, where the burden of HIV-associated TB was highest, showed that 86% of patients with TB had been tested for HIV. A total of 456,426 cases of TB-HIV co-infection have been reported (Global tuberculosis report, 2020).

To this end, the city of Bongor, capital of the Province of Mayo-Kébbi/Est which is one of the most populated Provinces of the Republic of Chad, is experiencing this situation of TB/HIV co-infection which is important in contamination term. This situation of infections has led health actors to hypothesize that the living conditions, certain behaviors and social habits of the population of Bongor, favor tuberculosis contamination and HIV at the origin of the co-infection TB/HIV. It is with this in mind that this research work was initiated to determine the prevalence of TB/HIV co-infection and to assess the level of contamination of patients screened in each district of the city of Bongor.

Materials and Methods

Ethical considerations

We were able to carry out this research work thanks to approval N°32 /PR/PM/MSP/SG/DGAS/DSRM KE/HRB/18 from the Provincial Hospital of Bongor. Indeed, the patients came to be screened voluntarily and the results obtained were offered as part of the follow-up of these patients.

Presentation of the city of Bongor

The city of Bongor is the capital of the Mayo-Kébbi/Est Province, located halfway (235 km) between N'Djamena and Moundou (Figure 1). It is bordered to the North-East by the Province of Chari Baguirmi, to the South-East by Tandjilé, to the South-West by the Province of Mayo-Kébbi/Ouest and to the West by the Republic of Cameroon (Geographical location of the city of Bongor, Wikipedia).

Geographically speaking, it is located between 10.280° North latitude and 15.370° East longitude. Thus, the city of Bongor is built along the Logone River, one of the longest rivers in Chad, on a sandy bead which is sheltered from the highest floods of the Logone (Geographical location of the city of Bongor, Wikipedia). Figure 1 below shows the map of the city of Bongor established in 2018 (Geographical location of the city of Bongor, Wikipedia).

The neighborhoods selected for this study

Seventeen (17) of the following districts were selected for this study: Ardep, Bongor Siéké, Commerçant, Darkawaye, Djambal-Bahr, Djamboutou, Djoh-Bongor, Fordamba, Golongtougou, Goulmoun Bassi, Lama-Lama, Largeau, Maïlao, Miogoye Blah, Raouna, Silé 1 and Silé 2. The number of inhabitants of these neighborhoods is estimated at 186,088.

Setting and study population

This observational, descriptive and analytical prospective cohort study took place from January 2019 to December 2021 in the Department of Phtisiology and the medical analysis laboratory of the Provincial Hospital of Bongor (HPB), including the files of 320 patients including 219 men and 101 women. These patients were composed of 283 new cases and 08 whose TB/HIV status was well known.

According to the breakdown by year, we have 126 patients in 2019, 113 in 2020 and 124 in 2021. However, 43 patients were not eligible for lack of certain information on sociodemographic characteristics.

Samples collection

Two (02) sputum samples were collected per patient who coughed for two weeks or more and for the HIV test, only one (01) blood sample was taken per patient.

Samples processing

Ziehl–Neelsen staining

Direct sputum smear microscopy is the most widely used method for diagnosing tuberculosis. The Ziehl Neelsen stain plays an important role in the diagnosis of any mycobacterial infection. It is quick and simple to perform. Despite its low sensitivity, it remains an essential bacteriological examination in our laboratories where the culture of Mycobacteria is not carried out. Sputum samples were processed according to standard clinical microbiology methods (Muddaiah *et al.,* 2013; Yon Ju Ryu, 2015).

PCR analysis technical (HIV) with the Xpert automaton (EDTA tube method)

The method involves drawing a patient's blood into an EDTA (Ethylene Diamine Tetraacetic Acid) tube and mixing it. Pipette 750 µl of the HIV diluent then put it in the GeneXpert cartridge. Then, pipette 100 µl of whole blood and also put it in the same GeneXpert cartridge and mix gently. Then insert the cartridge into the GeneXpert device, looking for the analysis parameter and wait 1 hour 34 minutes for the result. If the sample is positive, the device mentions: HIV detected and if it is negative, it mentions: HIV not detected (Sharma *et al.*, 2014; Ba-Diallo *et al.,* 2016).

Statistical analyzes

The data from this study were transferred into Microsoft Excel 2007 software and then imported into Epi Info 7™ software (Center for Disease Control and Prevention, Atlanta, GA, USA) for further analysis. For continuous variables, the mean and the standard deviation were calculated.

The tests were performed according to sample size using a 95% level of confidence interval (CI) which indicates a more precise estimate of the parameter. All percentages are preceded by their absolute values. The results are presented in the form of tables and figures.

Results and Discussion

Study population and analysis of the treatment with Ziehl-Neelsen staining of the samples obtained

For this study, the population was 320. A total of 640 sputum samples and 320 blood sample tubes were collected. After reading and re-reading the slides, we obtained 180 (56.25% [95% CI: 50.62% - 61.73%]) positive samples and 140 (43.75% [95% CI: 38.27% - 49.38%]) negative samples. This population was composed of 283 (88.44% [95% CI: 84.29% - 91.63%]) new cases, 37 (11.56% [95% CI: 8.37% - 15.71%]) case in retreatment. This study population included 219 (68.44% [95% CI: 62.99% - 73.43%]) men and 101 (31.56% [95% CI: 26.57% - 37.01%]) women. The ages ranged from 2 to 80 years old. The average age was 37.9 years with a standard deviation equal to 14.7.

In our study, men were more affected than women. We noted a new phenomenon of contamination of tuberculosis in this province which is that of the use of the Hookah or the "Chicha" which is a water pipe used to smoke tobacco of which several people aspire the same tip (Hicham *et al.,* 2014). This phenomenon is also worrying in Oran, Algeria, where a third of new cases of tuberculosis recorded in recent months are directly linked to the consumption of "Chicha" (Sofiane, the Daily of Oran 2012).

Prevalence of TB/HIV co-infection

After analysis of the 320 blood samples, we obtained 65 (20.31% [95% CI: 16.13% - 25.23%]) seropositive samples and 255 (79.69% [95% CI: 74.77% - 83.87%]) seronegative. TB/HIV co-

infected patients were 55 (17.19% [95% CI: 13.31% - 21.87%]) including 29 (09.06% [95% CI: 6.25% - 12.89 %]) men and 26 (08.13% [95% CI: 5.48% - 11.82%]) women.

In this study, the prevalence of TB/HIV co-infection circulating in the city of Bongor was 17.19%, this rate is significant and according to our surveys, lifestyles in a context of generalized poverty could be the elements of explanation.

Our prevalence is a little lower compared to studies done in Ethiopia at the Shegaw Motta district hospital in the Amhara region, where the prevalence of TB / HIV co-infections was 18.1% and 27.7% respectively, then one of the contamination factors was alcohol (Aweke *et al.,* 2016; Abebe *et al.,* 2020). Another study done in northeast Malaysia showed that the majority of TB patients with HIV co-infection were male patients (91.1%) (Tengku *et al.,* 2017) which is significantly higher ours (09.06%).

Distribution of TB/HIV co-infected patients according to age groups

The analysis of Figure 2 shows the most affected age group, which is that of 32 - 38 years representing 32.73% of patients. The research teams of Pascalina in Zambia and Diarra in Mali had made the same observations as ours in their studies but with a slightly higher percentage of 50% and 75% respectively. These results show that tuberculosis affects the very active adult population, which constitutes a negative obstacle in terms of the economic development of these countries (Pascalina *et al.,* 2017; Diarra *et al.,* 2019).

Distribution of co-infection by neighborhood

Table 1 presents the number of patients by year with their TB/HIV co-infection status in the selected districts of the city of Bongor. We report higher co-infection in 2019 with a decrease in 2020 and then an increase in 2021.

Table.1 Number of co-infections per quarter and per year.

Neighborhoods	2019	2020	2021	Cumulative percentage
Ardep	2 (0.018)	1 (0.009)	0	0.027
Bongor Siéké	1 (0.007)	0	0	0.007
Commerçant	3 (0.020)	1 (0.006)	3 (0.020)	0.046
Djoh-Bongor	5 (0.040)	1 (0.008)	3 (0.020)	0.068
Golongtougou	2 (0.016)	4 (0.032)	2 (0.016)	0.064
Goulmoun Bassi	0	2 (0.018)	0	0.018
Lama-Lama	3 (0.025)	0	3 (0.025)	0.05
Largeau	1 (0.006)	3 (0.020)	5 (0.034)	0.06
Maïlao	2 (0.012)	2 (0.012)	2 (0.012)	0.036
Miogoye Blah	1 (0.016)	0	0	0.016
Silé 1	1 (0.006)	2 (0.013)	0	0.019
Total	**21 (0.166)**	**16 (0.118)**	**18 (0.127)**	**0.41**

Fig.1 Map of the city of Bongor 2018.

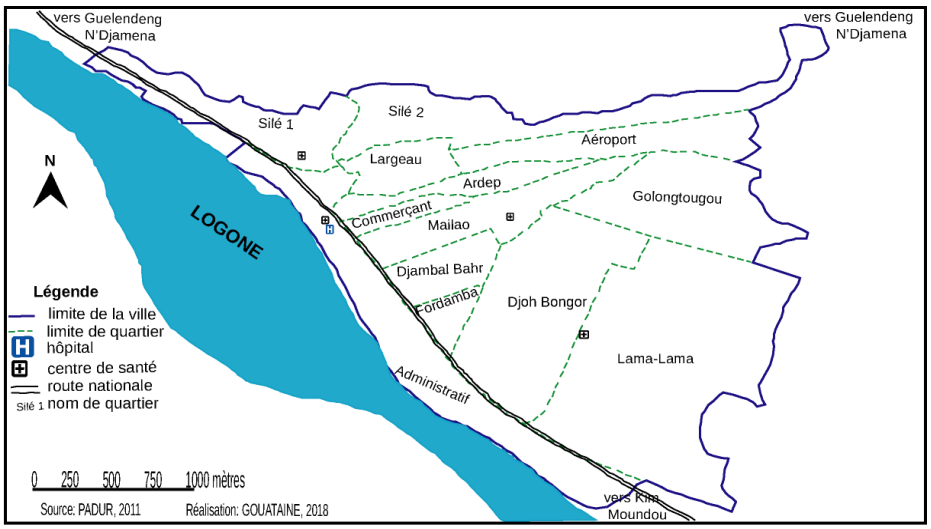
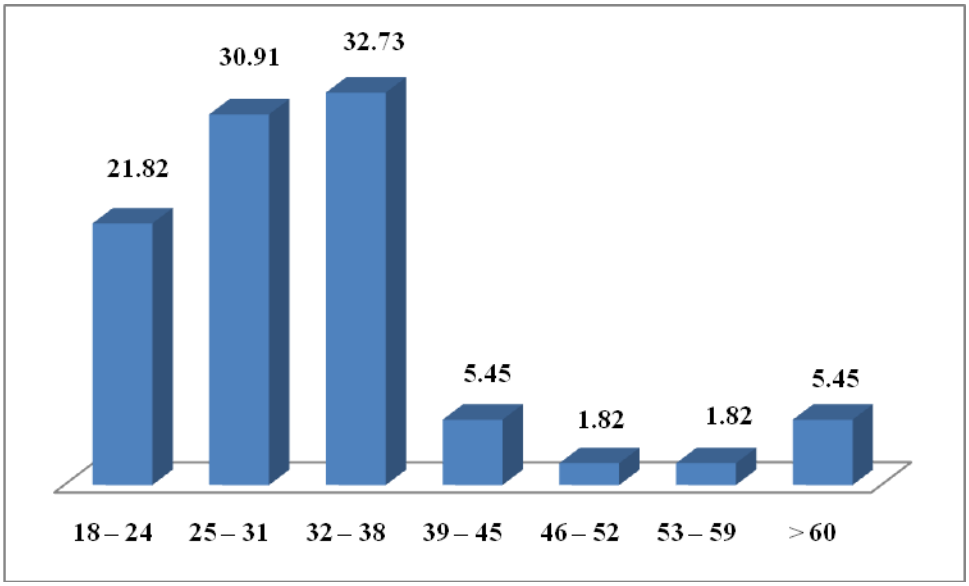


Fig.2 TB/HIV co-infected patients by age group.



Analysis of Table.1 shows that the majority of neighborhoods are affected by TB/HIV co-infection. The position of the city of Bongor halfway between the two administrative and economic cities of Chad and that of Yagoua in Cameroon could explain this diversified rate of contamination in most neighborhoods because of the mobility of the population investigating better living conditions of life. We also report the use of drugs, alcohol, sex workers etc. A study by Peters and his team showed the same pattern as ours on vulnerable populations including minors, children, migrants, prisoners, sex workers, people who use drugs or alcohol who live in settings where TB and HIV are endemic (Peters *et al.*, 2019).

TB/HIV co-infection in the city of Bongor, which is significant in terms of contamination, affects 11 out of 17 neighborhoods. Despite the advanced screening strategies organized by the National Tuberculosis Control Program and the National AIDS Control Council, co-infection is gaining

ground and the State must put enough resources into it to raise awareness.

Acknowledgement

We sincerely thank the officials of the Provincial Hospital of Bongor who have spared no effort for the completion of this research work. Patients are also thanked for their willingness to seek health while protecting others. Higher Normal School of Bongor, for having financially supported this research work.

Conflicts of interest

No author has declared any conflicts of interest.

Author contributions

Gédéon Walbang Ossoga and Aïssatou Gaye Diallo: development and finalization of the study project; Gédéon Walbang Ossoga, Bakarnga-Via Issakou: data collection and analysis, manuscript writing; Awa Ba Diallo: critical analyzes and amendment of the manuscript; Yanda Mberkissam Daniel, Mamadou: manipulations and laboratory analyses; Bemadji Namarde Simplice, Limassou Saleh: surveys and demographic data; Gédéon Walbang Ossoga: statistical analyses; Aïssatou Gaye Diallo supervised the work until its completion. All authors have read and approved the clean version of the manuscript.

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How to cite this article:

Gédéon W. Ossoga, Bakarnga-Via Issakou, Awa Ba-Diallo, Yanda M. Daniel, Mamadou Abderamane, Bemadji N. Simplice, Limassou Saleh and Aïssatou G. Diallo. 2022. Prevalence of HIV in Patients with Pulmonary Tuberculosis in the City of Bongor in Chad. *Int.J.Curr.Microbiol.App.Sci.* 11(11): 134-140.
doi: https://doi.org/10.20546/ijcmas.2022.1111.017