



## Research Article

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# Particularities of radiological lesions in smear-positive and HIV-positive tuberculosis patients in the era of triple antiretroviral therapy at Jamot Yaoundé hospital

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## Abstract

**Introduction:** The aim of this work was to compare the radiological lesions during bacilliferous tuberculosis between HIV positive patients under ARV treatment and HIV negative patients. **Methodology:** This was a, descriptive and comparative study conducted from December 1, 2018 to May 31, 2019 (6 months) at Jamot Yaoundé Hospital. Smear-positive tuberculosis patients meeting our inclusion criteria were enrolled in the study. We split them into two groups, HIV + and HIV -. The comparison of the data was made by the Chi<sup>2</sup> test, that of the quantitative data with the Student's T test. A p-value less than 0.05 was considered significant. **Results:** In total, we recruited 145 patients divided into 2 groups of 63 HIV + patients and 82 HIV-patients. The radiological peculiarities found in HIV were as follows: Normal radiography was more frequent, P = 0.004. Interstitial syndrome was less common. Bilateral involvement was predominant. Right localization and upper lobe lesions were less frequent, P <0.05. Micronodular lesions were more frequent, P <0.05. During the alveolar syndrome, the left side was less affected and the upper lobe was the most; p <0.05. Cavitory, pleural, mediastinal and bronchial syndromes did not show statistically significant differences. **Conclusion:** Although a normal x-ray does not exclude pulmonary tuberculosis, the x-ray lesions are multiple but are dominated by the interstitial syndrome. In patients immunocompromised to HIV, bilateral involvement predominates. The right localization and lesions of the upper lobe are less frequent. Micronodular lesions are frequent.

**Keywords:** Tuberculosis, Smear positive, HIV, Radiological lesions.

## INTRODUCTION

Tuberculosis (TB) is an infectious disease caused by Mycobacterium tuberculosis. With the advent of HIV, we have seen an upsurge in this deadly disease.

The diagnosis of smear-positive pulmonary tuberculosis (SPTB+) involves the detection of the tuberculous bacillus, medical imaging, in this case the chest x-ray, is a great contribution to the diagnosis. It makes it possible to evoke the diagnosis of TB on the appearance and site of the lesions.

There are three types of lesions suggestive of TB: caverns, nodules and infiltrates. These 3 lesions can be associated and preferentially sit in the upper or posterior segments of the lung where the oxygen content is the highest <sup>[1]</sup>. Co-infection with HIV tends to make these radiological lesions atypical, occurring more frequently in the middle and basal regions of the lungs Reticulo-nodular opacities, bilateral and extensive, diffuse micronodular opacities of miliary type are more frequent, on the other hand, caves are rare <sup>[2]</sup>.

It is important to control the radiological aspects of tuberculosis in its smear-positive pulmonary form in both HIV-immunocompromised and immunocompetent subjects. It is of great interest in the diagnosis, therapeutic management and follow-up of patients.

The aim of this study was to compare the radiological lesions of smear-positive tuberculosis patients with HIV-positive and HIV-negative patients in the era of triple antiretroviral therapy.

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## PATIENTS AND METHODS

We carried out a prospective, cross-sectional, and comparative study using a mixed, quantitative and qualitative approach, aiming to compare the radiographic aspects during pulmonary tuberculosis between the HIV positive patient on ARV treatment and the HIV negative patient. The study took place from December 1, 2018 to May 31, 2019 (6 months), at Jamot Hospital in Yaoundé (HJY). Indeed, the Jamot hospital is the reference center for the management of respiratory and psychiatric illnesses in Yaoundé and its surroundings.

### Study population

The target population for the study were patients with smear-positive pulmonary tuberculosis (SPTB +) diagnosed at the time of the survey.

### Inclusion criteria

- Patients aged 18 and over;
- HIV positive patients on ARVs for at least 6 months and HIV negative patients;
- Patients who have had a standard chest x-ray.

### Exclusion criteria

- Patients not consenting to participate in the study.
- Patients co-infected with HIV / BK who have stopped their ARV treatment.
- HIV / BK coinfecting patients naïve to antiretroviral treatment.

### Data collection

A structured and pretext questionnaire was used for the collection of study data. This questionnaire was administered orally by 7th year medical students. The registers of the bacteriology laboratory were consulted for smear-positive tuberculosis patients. Once found, these patients were searched for in the various hospital wards. For the patients followed externally, they were recruited at the diagnostic and treatment center (CDT). The CDT is a compulsory registration center for all patients with non-multidrug-resistant tuberculosis before they are supplied with anti-tuberculosis drugs.

Eligible, informed and consenting patients were successively recruited and interviewed.

All chest x-rays were read by a radiologist. We performed non-probability and consecutive sampling.

The information collected was:

- Sociodemographic data: age, sex,
- Clinical data: medical history (HIV infection, history of TB)
- The data of the chest x-ray.

### Statistical analysis

The data were entered on Cs pro version 7.2. Analysis was performed using spss software version 23.0. Qualitative data was represented as numbers and frequencies. Quantitative data was represented by its mean and standard deviation. The comparison of the data was done by the Chi<sup>2</sup> test, while that of the quantitative data with the Student's T test. A p-value less than 0.05 was considered significant.

### Ethical considerations

For the performance of this study, we obtained an ethical clearance from the ethics committee of the Faculty of Medicine and Pharmaceutical Sciences of Douala.

A recruitment authorization was obtained from the administrative authorities of the HJY before the start of the study. Oral informed

consent was obtained from each study participant, for those under 21 parental consent was required.

The confidentiality and anonymity of each participant were respected for the personal data collected

## RESULTS

From December 1, 2018 to May 31, 2019, we recruited patients aged 18 and over, hospitalized or outpatient for smear-positive pulmonary tuberculosis, in the pulmonology departments of the JHY and collected 145 cases.

### Sociodemographic and Clinical data

The mean age  $\pm$  standard deviation (range) of the HIV + group was 41.1 years  $\pm$  12.4 (18 and 84 years) versus 39.8 years  $\pm$  14.8 (21 and 84 years) for HIV negative. But there was no statistically significant difference between the two groups.

The male sex was more represented in both groups. However, the proportion of males and females was almost identical in the HIV positive group; the sex ratio being 1.03 against 3.31 for the HIV negative group.

HIV+ patients were more than two times more likely to have Tuberculosis than HIV- patients [OR (95% CI) = 2.64 (1.03-6.77) P = 0.038].

No statistically significant association was found between HIV status and alcohol consumption, tobacco or Diabetes and Arterial Hypertension. (P > 0.05). (Table. 1 and 2).

**Table 1:** Epidemiological characteristics. Particularities of radiological lesions in smear-positive and HIV-positive tuberculosis patients in the era of triple antiretroviral therapy at Jamot hospital in Yaounde, December 1, 2018 - May 31, 2019. HIV positive (N = 63), HIV negative (N = 82). Continuous variables are presented as mean  $\pm$  standard deviation and categorical variables in numbers (proportion in%).

Variables	Modalities	HIV+	HIV-	P Value
Average age in years		41.1 $\pm$ 12.4	39.4 $\pm$ 14.8	0.482
Age groups	[18-25]	2 (3.2)	15 (18.5)	0.005
	[25-35]	13 (20.6)	22 (26.8)	0.388
	[35-45]	31 (49.2)	14 (17.1)	<0.0001
	[45-55]	8 (12.7)	21 (25.6)	0.054
	[55-65] $\geq$ 65	5 (7.9) 4 (6.3)	3 (3.7) 7 (8.5)	0.294 0.757
Sex	Male	32 (50.8)	63 (76.8)	0.001
	Female	31 (49.2)	19 (23.2)	0.001

**Table 2:** Clinical data. Particularities of radiological lesions in smear-positive and HIV-positive tuberculosis patients in the era of triple antiretroviral therapy at Jamot hospital in Yaounde, December 1, 2018 - May 31, 2019. HIV positive (N = 63), HIV negative (N = 82). Categorical variables are presented in numbers (proportion in%).

Variables	VIH +	VIH	OR (IC - 95%)	Valeur p
Diabetes	1(1.6)	5(6.1)	0.25 (0.03 – 2.2)	0.233
High Blood Pressure	0 (0.0)	2 (2.4)	-	0.505
Alcohol	29 (46.0)	46 (56.1)	0.67 (0.35 – 1.3)	0.229
Tobacco	17(27.0)	34 (41.5)	-	0.194
Tuberculosis	14(22.2)	8 (9.8)	2.64 (1.03 - 6.77)	0.038

## Radiological data

Normal radiography was more frequent in HIV + patients [(34.9% versus 14.6%) P = 0.004]

### Particularities of radiological lesions seen on the chest x-ray of HIV + patients.

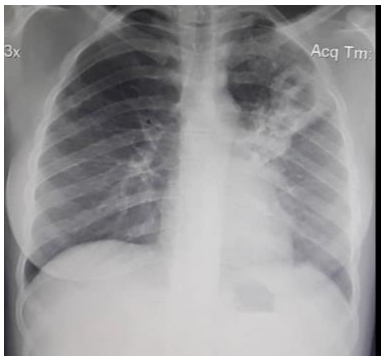
Interstitial syndrome was the most common abnormality in both groups; however, HIV + patients had a lower risk of developing interstitial syndrome [65.1% versus 85.4%; OR (95% CI) = 0.32 (0.14 - 0.71); 0.004].

Alveolar syndrome was also less present in HIV + [(19.0%) versus (35.4%) for HIV negatif; P = 0.031].

Although there is a variation in the frequency of pleural disorders and cavity, mediastinal and bronchial syndroms between HIV+ and HIV- groups, the difference is not statistically significant. (Figure 1 and 2; Table 3)



**Figure 1:** Bilateral encysted pleural effusion on the left. Bilateral hyloaxillary interstitial syndrome. Patient HIV positive.



**Figure 2:** Cavitary and interstitial syndrome. Patient HIV negative.

**Table 3:** Radiological data. Particularities of radiological lesions in smear-positive and HIV-positive tuberculosis patients in the era of triple antiretroviral therapy at Jamot hospital in Yaounde,, December 1, 2018 - May 31, 2019. HIV positive (N = 63), HIV negative (N = 82). Categorical variables are presented in numbers (proportion in%).

Variables	HIV+	HIV-	OR (IC 95%)	P Value
Interstitiel syndrome	41 (65.1)	70 (85.4)	0.32 (0.14 – 0.71)	0.004
Cavitary syndrome	21 (33.3)	21 (25.6)	0.7 (0.31 - 1.5)	0.35
Alveolar syndrome	12 (19.0)	29 (35.4)	0.43 (0.2-0.93)	0.031
Pleural syndrome	10 (15.9)	12 (14.6)	1.1 (0.44 – 2.74)	0.837
Médiastinal syndrome	7 (11.1)	9 (11.0)	1.04 (0.36 – 2.9)	0.98
BronchialSyndrome	4 (6.3)	8 (9.8)	0.63 (0.2 – 2.2)	0.46

### Particularities of interstitial syndrome in HIV positive patients.

It was less common 65.1% versus 85.4%.

Bilateral pulmonary field involvement was predominant in HIV +

The right-hand location was less frequent in the HIV + group, ie [7.9% versus 25.6%; OR (CI) = 0.25 (0. 0.9-0.71); P = 0.006].

The predominant location in HIV + patients was throughout the lung.

Lesions located in the upper lobe were less frequent in the HIV + population [(17.5% versus 35.4%); P = 0.002].

Micronodular lesions predominated in HIV + and were more frequent than that found in HIV- [(39.7%) versus (19.5%); P = 0.008].

Reticulonodular lesions were less frequent in HIV + [(22.2%) versus (53.7%); P <0.0001]

All these data are summarized in Table 4.

**Table 4:** Characteristics of interstitial syndrome. Particularities of radiological lesions in smear-positive and HIV-positive tuberculosis patients in the era of triple antiretroviral therapy at Jamot hospital in Yaounde, December 1, 2018 - May 31, 2019. HIV positive (N = 63), HIV negative (N = 82). Categorical variables are presented in numbers (proportion in%).

Variables	Modalities	VIH+	VIH -	OR (IC 95%)	P value
Côté atteint	Right	5 (7.9)	21(25.6)	0.25 (0.09-0.71)	0.006
	Left	6 (9.6)	13 (15.9)	0.6 (0.2 -1.6)	0.656
Localisation	Bilateral	30 (47.6)	36 (43.9)	1.2 (0.6 - 2.25)	0.521
	Supérieur lobe	8 (12.7)	29 (35.4)	0.27 (0.11- 0.63)	0.002
	Middle lobe	1(1.6)	9(11.0)	0.13 (0.02-1.06)	0.043
	Inferior lobe	3(4.8)	5(6.1)	0.8 (0.2-3.35)	1
	Whole lung	29 (46.0)	27(32.9)	1.74 (0.9-3.42)	0.108
Type of lesions	Micronodular	25(39.7)	16(19.5)	2,71(1.3-5.71)	0.008
	Réticulonodular	14 (22.2)	44 (53.7)	0.25 (0.12 – 0.52)	<0.0001
	Nodular	2 (3.2)	10 (12.2)	0.24 (0.05-1.12)	0.051

### Features of cavitary syndrome

The variation of frequency of the affected side among HIV+ and HIV- is not statistically significant. We noted however that no bilateral lesions was found among HIV+ patients.

Within each group, the upper lobes were the most affected.

### Features of alveolar syndrome.

The left side was less affected in HIV positive [(1.6%) versus (13.4%); p = 0.010]

The upper lobe was the predominant location and the most frequently affected lobe in HIV + compared to HIV- [(17.1%) versus (1.6%); p = 0.002]

All these data are summarized in Table 5.

**Table 5:** Features of cavitory and alveolar syndromes. Particularities of radiological lesions in smear-positive and HIV-positive tuberculosis patients in the era of triple antiretroviral therapy at Jamot hospital in Yaounde,, December 1, 2018 - May 31, 2019. HIV positive (N = 63), HIV negative (N = 82). Categorical variables are presented in numbers (proportion in%).

Variables	Modalities	VIH+	VIH -	OR (IC 95%)	P value
Cavitory syndrome					
Affected side	Right	5(7.9)	11(13.4)	0.6 (0.2 – 1.7)	0.297
	Left	7(11.0)	8 (9.8)	1.16 (0.4 – 3.4)	0.791
	Bilateral	0 (0.0)	2 (2.4)	//	0.505
Localisation	Superior lobe	8 (12.7)	16 (19.5)	0.6 (9.24 – 1.5)	0.274
	Middle lobe	2 (3.2)	4 (4.9)	0.64(0.11-3.61)	0.697
	Inferior lobe	1 (1.6)	1 (1.2)	1.31(0.08- 21.3)	1
Alveolar syndrome					
Affected side	Right	8 (12.7)	9 (11.0)	1.2 (0.43-3.25)	0.749
	Left	1(1.6)	11(13.4)	0.10(0.01-0.83)	0.010
	Bilateral	3 (4.8)	10 (12.2)	0.36 (0.1-1.4)	0.120
Localisation	Superior lobe	14 (17.1)	1(1.6)	0.08 (0.01- 0.61)	0.002
	Middle lobe	1 (1.2)	2 (3.2)	2.7 (0.24 - 30)	0.580
	Inferior lobe	4 (4.9)	3 (4.8)	1(0.21 – 4.5)	1
	Whole lung	11(13.4)	6 (9.5)	0.7 (0.24 - 2)	0.470

#### Characteristics of pleural syndrome

The findings cannot be analysed meaningfully due to the small number of cases recorded in both groups. However, we can highlight the fact that no bilateral lesion, no pneumothorax and no calcification were found in the HIV- group. Similarly, no large effusion and no cystic collection was noted on the HIV+ group.

We can also point out the fact that 9 HIV+patients (14,3 %) had an average amount of fluid and 8 HIV+ patients (12,7 %) had fluid located in the lower lobe.

#### Characteristics of bronchial and mediastinal syndromes

Due to the small number of cases with bronchial and mediastinal syndrom, no meaningful analysis of this section can be made. We can simply highlight the fact that for the mediastinal syndrom, no bilateral lesion and no lesion affecting the whole lung was found on HIV-patients. For the bronchial syndrom, no lesion localised in the lower lobe was noted.

All these data are summarized in Table 6.

**Table 6:** Characteristics of pleural, bronchial and mediastinal syndrome. Particularities of radiological lesions in smear-positive and HIV-positive tuberculosis patients in the era of triple antiretroviral therapy at Jamot hospital in Yaounde, December 1, 2018 - May 31, 2019. HIV positive (N = 63), HIV negative (N = 82). Categorical variables are presented in numbers (proportion in%).

Variables	Modalities	HIV+	HIV-	OR (IC 95%)	P- value
Pleural syndrome					
Affected side	Right	3 4.8	7 ( 8.5)	0.54 (0.13 -2.2)	0.514
	Left	6 (9.5)	5 (6.1)	1.6 (0.5 - 5.6)	0.533
	Bilateral	1 (1.6)	0 (0.0)	//	0.434
Type	Pleurisy	5 (7.9)	8 (9.8)	0.8 (0.25 - 2.6)	0.504
	Pneumothorax	2 (3.2)	0 (0.0)	//	0.187
	Pachypleuritis	2 (3.2)	4 (4.9)	0.7 (0.11 – 3.61)	0.697
Pleural calcifications		1 (1.6)	0 (0.0)	//	0.434
Abondance	Small	1. (1.6)	2(2.4)	0.65 (0.06 -7.3)	1
	Medium	9 (14.3)	7(8.5)	1.8 (0.63 – 5.1)	0.273
	Large	0 (0.0)	2 (2.4)	//	0.505
Localisation	Encysted	0 (0.0)	4 (4.9)	//	0.133
	Middle lobe	1 (1.6)	2 (2.4)	0.65 (0.06 -7.3)	1
	Inferior lobe	8 (12.7)	5 (6.1)	2.24 (0.7-7.22)	0.168
	Whole lung	1 (1.6)	1(1.6)	1.31 (0.08-21.3)	1
Bronchial syndrome					
Affected side	Right	2 (3.2)	4 (4.9)	0.64 (0.11 - 3.6)	0.472

	Left	1 (1.6)	4 (4.9)	0.32 (0.03 - 2.9)	0.388
	Bilateral	1 (1.6)	0 (0.0)	//	0.434
Affected lobe	Superior lobe	1 (1.6)	2 (2.4)	0.65 (0.6 - 7.3)	1
	Middle lobe	2 (3.2)	4 (4.9)		0.697
	Inferior lobe	0 (0.0)	2 (2.4)	//	0.505
	Whole lung	1 (1.6)	0 (0.0)	//	0.434
Type of lesions					
	Bronchiectasis	3 (4.8)	7 (8.5)	0.64 (0.11 - 3.6)	1
	Bronchial thickening	1 (1.6)	1 (1.2)	//	-
Mediastinal syndrome					
lymphadenopathy	Paratrachal	1 (1.6)	3 (3.7)	0.42 (0.04 - 4.18)	0.633
	Hilar	6 (9.5)	8 (9.8)	0.97 (0.32 - 3)	0.963
	Anterior	6 (9.5)	9 (11.0)	0.85 (0.3 - 2.25)	0.776
	Inferior	1 (1.6)	0 (0.0)	//	0.434

## DISCUSSION

This prospective, descriptive and analytical study took place in the pulmonology departments of the HJY from December 1, 2018 to May 31, 2019. It involved 145 patients, 63 of whom were co-infected with HIV / BK.

The aim of this work was to compare the radiological lesions of smear-positive pulmonary tuberculosis in HIV patients on ARVs and HIV-negative patients.

Relapses of tuberculosis were more frequent in HIV-positive patients [(22.2% versus 9.8%)  $p = 0.038$ ].

In the natural history of HIV infection, tuberculosis occurs at a relatively early stage, before other opportunistic infections (pneumocystosis, cryptococcosis, toxoplasmosis). The most frequent form of tuberculosis in patients infected with HIV is pulmonary tuberculosis, exclusive in 55 to 60% of cases. A history of tuberculosis is often found, which favors endogenous reinfection [3].

The impact of HIV-AIDS is twofold:

- Direct with an increased risk for HIV-positive people to become infected

- Indirect since infected HIV subjects quickly become ill and represent additional sources of contamination [3]. Pulmonary TB lesions following TB sequelae are often complex and often require computed tomography of the chest in the absence of smear-positive [4 dautzenberg]

In our series, the chest radiograph was normal in 34.9% of HIV + patients versus 14.6% of HIV negative patients. This could be explained by the failure of the immune system which becomes incapable of triggering the inflammatory reaction generating the granuloma responsible for tissue necrosis [5].

Interstitial syndrome was less common in HIV + patients [(65.1% versus 85.4%),  $p = 0.004$ ]. This result differs from that of Assao *et al.* who noted a more frequent proportion of interstitial syndrome, ie 96.8% [5].

Bilateral attacks predominated in HIV +; this result is in agreement with the data in the literature [2]. La localisation des lésions à droite était moins fréquentes dans le groupe de VIH + [7.9 % versus 25.6%; OR(IC)=0.25(0.09 - 0.71);  $P=0.006$ ].

Lesions located in the upper lobe were less frequent in the HIV + population [(17.5% versus 35.4%);  $P = 0.002$ ]. Indeed, during HIV,

radiological lesions are more frequently located in the middle and basal regions of the lungs [2].

Micronodular lesions were more frequent than that found in HIV- [(39.7%) versus (19.5%);  $P = 0.008$ ]. Several studies have found a predominance of miliaria among seropositive [6, 7].

Reticulonodular lesions were less frequent in HIV + [(22.2%) versus (53.7%);  $P < 0.0001$ ]

Cavity syndrome was more common in HIV + (33.3% versus. 25.6%;  $P = 0.35$ ). But this difference was not statistically significant. In the series by Kombila *et al.* 59.1% had cavitory lesions [8].

During the alveolar syndrome, the left side was less affected in HIV positive [(1.6%) versus (13.4%);  $p = 0.010$ ]. The upper lobe was most frequently affected in HIV + compared to HIV- [(17.1%) versus (1.6%);  $p = 0.002$ ].

Many authors have described a predominance of lesions in the left upper lobe in HIV negative subjects [8, 9, 10]. This could be explained by the fact that the left mainstem bronchus is considerably longer and longer. narrow than the right main bronchus and the left peribronchial region is limited by the proximity of the aorta. To this end, this bronchus is more prone to poor drainage and extrinsic compression by adjacent lymphadenopathy, hence the vulnerability of the left lung to chronic infections [10].

The other syndromes were not unique in HIV positive.

## CONCLUSION

A chest x-ray is of great help in the diagnosis of pulmonary tuberculosis. Although a normal x-ray does not exclude pulmonary tuberculosis, the x-ray lesions are multiple but are dominated by the interstitial syndrome. In patients immunocompromised to HIV, bilateral involvement is predominant. The right localization and lesions located in the upper lobe are less frequent. Micronodular lesions are more common.

## Conflicts of interest

The authors declare no conflict of interest.

## Funding

None.

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