

Community-acquired lower respiratory tract infections in an adult population with HIV infection in a Nigerian tertiary hospital

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Abstract

Objective: Lower respiratory tract infections (LRTI) are 25-fold more common in people with HIV than in the general population. This study aimed to determine the prevalence of community-acquired LRTI and its associated factors in an adult population of people living with HIV (PLWH) in a Nigerian tertiary Hospital.

Methodology: This was a prospective study done at the HIV clinic of Ladoke Akintola University of Technology (LAUTECH) Teaching Hospital Osogbo, Nigeria. It involved 130 randomly selected adult participants with a confirmed HIV-positive serology. The participants were followed up for a period of one year while looking out for symptoms and signs suggestive of LRTI.

Results: The participants had a mean age of 41.9±10.02 years and a male to female ratio of 0.4:1. Seventeen (13.9%) of the participants developed LRTI during the study period and this was significantly associated with CD4 count and cigarette smoking history.

Conclusion: LRTI is common among PLWH in Osogbo, and it occurs more commonly in those with low CD4 T cell count and those with a history of cigarette smoking.

Keywords: Lower respiratory tract infection, HIV, pneumonia.

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Infections des voies respiratoires inférieures acquises dans la communauté et ses facteurs associés dans une population adulte infectée par le VIH dans un hôpital tertiaire nigérian

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Résumé

Objectif de l'étude : Les infections des voies respiratoires inférieures (IVRI) sont 25 fois plus fréquentes chez les personnes séropositives que dans la population générale. Cette étude visait à déterminer la prévalence du LRTI acquis dans la communauté et ses facteurs associés dans une population adulte de personnes vivant avec le VIH (PVVIH) dans un hôpital tertiaire nigérian.

Méthode de l'étude : Il s'agissait d'une étude prospective réalisée à la clinique VIH de l'hôpital universitaire de Ladoke Akintola University of Technology (LAUTECH) d'Osogbo, au Nigéria. Il impliquait 130 participants adultes sélectionnés au hasard avec une sérologie séropositive confirmée. Les participants ont été suivis pendant une période d'un an tout en recherchant des symptômes et des signes évocateurs de LRTI.

Résultat de l'étude : Les participants avaient un âge moyen de $41,9 \pm 10,02$ ans et un rapport homme/femme de 0,4: 1. Dix-sept (13,9%) des participants ont développé un LRTI au cours de la période d'étude, ce qui était significativement associé au nombre de CD4 et aux antécédents de tabagisme.

Conclusion: Le LRTI est célèbre chez les PVVIH à Osogbo, et il se produit plus fréquemment chez les personnes ayant un faible nombre de lymphocytes CD4 T et celles ayant des antécédents de tabagisme.

Mots-clés: infection des voies respiratoires inférieures, VIH, pneumonie

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INTRODUCTION

Lower respiratory tract infections (LRTI) remain a major cause of mortality globally. According to the 2015 global burden of disease study, LRTI is the third leading cause of death globally, surpassed only by ischemic heart disease and cerebrovascular disease (1). Human Immunodeficiency Virus (HIV) infection is one of the risk factors for LRTI. Other risk factors include age greater than 65 years, cigarette smoking, alcohol abuse, chronic obstructive pulmonary disease, congestive heart failure and poor dental condition (2-4). Despite the gains made in the fight against Human Immunodeficiency Virus/Acquired Immune Deficiency Syndrome (HIV/AIDS), the epidemic still remains a major challenge worldwide, particularly in sub-Saharan Africa. As at the end of 2019, about 38 million people around the world were said to be living with HIV, 25.6 million of these were in sub-Saharan Africa. In the same year, 1.7 million people became newly infected with the virus worldwide and there were 690,000 AIDS related deaths (5). Nigeria has the second highest number of people living with HIV/AIDS in the world after South Africa. As at the end of 2019, about 1.8 million people were said to be living with the virus in the country (6). Approximately 44,830 people died in Nigeria of AIDS in 2019 (6).

The respiratory system is the most frequently affected organ system by HIV infection and respiratory pathology is most commonly associated with morbidity and mortality among patients living with HIV/AIDS (7). The spectrum of respiratory diseases associated with HIV infection ranges from infectious to non-infectious diseases (7). Some of the non-infectious diseases associated with HIV infection include malignancies (such as Kaposi's Sarcoma) and obstructive sleep apnoea (8). About 70% of HIV patients develop a pulmonary complication during the course of the disease, mainly of infectious aetiology (9). LRTI are 25-fold more common in people with HIV than in the general population, occurring in about 90 cases per 1,000 person-years (10). Although ART has significantly reduced the incidence of opportunistic infections among PLWH (11,12), LRTI, not only AIDS-related opportunistic infections, still remain a major cause of hospitalization and death among this group of people (13-15). Furthermore, community acquired Pneumonia (CAP) still remains the most frequent bacterial infection in PLWH, and it remains common even among those on ART and

with high CD4 counts (13,16,17).

Despite having the second highest number of people in the world with HIV/AIDS, and despite the high incidence and mortality associated with LRTI among PLWH, only a few studies have evaluated the prevalence of LRTI and its associated risk factors among PLWH in Nigeria. This study was therefore conceived with the aim of determining the prevalence of community-acquired LRTI and its associated factors in an adult population of PLWH in a Nigerian tertiary Hospital.

MATERIALS AND METHODS

Study area, study population and study design

The study was a prospective study carried out at the dedicated clinic to PLWH at Ladoko Akintola University of Technology (LAUTECH) Teaching Hospital Osogbo, Osun state. The study involved 130 randomly selected participants aged 18 to 65 years with a confirmed HIV-positive serology. Excluded were those who did not give consent, those with Diabetes Mellitus and those with pre-existing respiratory illness such as bronchial asthma, chronic obstructive respiratory disease, bronchiectasis and lung fibrosis. The participants were followed up for a period of one year from July 2015 to June 2016 while looking out for symptoms and signs suggestive of LRTI. During the follow up period the participants were seen in the clinic on a monthly basis and anytime they developed symptoms suggestive of LRTI. There was an exchange of phone numbers between the researcher and the participants (and their next of kin) to facilitate the follow up. The study objectives and procedures were explained to participants and informed consent (written and verbal) obtained. Ethical approval was obtained from the Ethics and Research Committee of LAUTECH Teaching Hospital, Osogbo with protocol number LTH/EC/2014/02/0165.

Socio-demographic and clinical data of the study participants were collected using a structured interviewer-administered questionnaire. All the study participants had a general physical examination and chest examination done at the commencement of the study, during the monthly follow up clinic visits and anytime during the study when any of the participants developed symptoms suggestive of LRTI. The weight and height were measured using a GIMA® ASTRA weighing scale with an inbuilt height meter. Baseline Chest X-ray, Full blood counts (FBC) and Erythrocyte sedimentation rate (ESR) were done for all the

participants at the commencement of the study. A random blood glucose was also done to exclude diabetes mellitus. The CD4+ T cell count of the participants was done at the commencement of the study to assess their immune status. In addition, the participants also had Chest X-ray, FBC and ESR done anytime within the study period when they developed any symptom suggestive of lower respiratory tract infection. Sputum for GeneXpert MTB/RIF assay was also done to exclude pulmonary tuberculosis.

Definition of Terms

Standardized definitions of infection were used for infection surveillance.

Definite Pneumonia: defined by chest x-ray demonstrating new infiltrate and at least one of new or increased cough, pleuritic chest pain, fever (temperature $>37.8^{\circ}\text{C}$ or at least 1.1°C rise from baseline), new or increased sputum production, new or changed lung examination abnormalities and respiratory rate of >25 cycles/minute (18). In addition to the above, patient must have any one of the following constitutional criteria including fever (as earlier defined), leucocytosis, acute change in mental status from baseline and acute functional decline in activities of daily living (18).

Probable Pneumonia: defined as in definite pneumonia but in the absence of Chest X-ray or new infiltrate on chest X-ray (18).

LRTI: defined as either Probable pneumonia or definite pneumonia.

Cigarette smoking history

Cigarette smoking history was positive if participants were either current cigarette smokers or former cigarette smokers. Former Smokers were defined as those who had smoked at least 100 sticks of cigarettes in their lifetime, but currently do not smoke while current smokers were defined as those who had smoked at least 100 cigarettes in their lifetime and currently smoke cigarettes every day or some days (19).

Data Management and Analysis

Data were entered into the computer and analysed using the Statistical Package for Social Sciences (SPSS) version 23.0 (SPSS Chicago Inc., IL, U.S.A). Relationship between categorical variables was determined using Chi-square and student T-test was used to compare means of independent groups. Level of significance was set at p-value less than 0.05.

RESULTS

Out of the 130 participants recruited for the study, only 122 participants had their data analysed. Eight of the participants dropped out of the study, giving a dropout rate of 6.2%. The participants had a mean age of 41.9 ± 10.02 years and a male to female ratio of 0.4:1. Mean duration since diagnosis of HIV and use of ART was 3.9 ± 2.84 years and 2.8 ± 2.33 years respectively. (Table 1) Seventeen (13.9%) of the participants developed LRTI during the study period. (Table 2) The development of LRTI was significantly associated with CD4 count and cigarette smoking history. (Table 3)

DISCUSSION

Diagnosis of pneumonia is not always confirmed radiologically and this was the case in our study. Hence, we used the term LRTI to refer to both the radiologically confirmed and the non-radiologically confirmed cases (definite and probable pneumonia). The study has shown that 13.9% of a cohort of adults with HIV infection developed LRTI within one year of follow-up and this was significantly associated with low CD4 T cell count and a positive history of cigarette smoking. Our finding of 13.9% is comparable to the 14.4% observed by Lamas C *et al.* who studied a cohort of PLWH in Brazil (20). Our finding is, however, higher than the 4% observed by Benard *et al.* (21). The reason for this difference is that while we included both the radiologically and non-radiologically confirmed cases, Benard *et al.* included only the radiologically confirmed cases. Radiologic evidence lags behind clinical findings suggestive of pneumonia; hence, excluding those without radiologic evidence may result into missing out some patients with pneumonia.

As expected, we also observed that development of LRTI was significantly associated with lower CD4 T cell count, as LRTI occurred in 28% of those with CD4 T cell count of <200 cells/ mm^3 as compared to 14% and 3% of those with CD4 T cell count of between 200 to 500 cells/ mm^3 and >500 cells/ mm^3 respectively. This finding is similar to those of earlier studies (22-24), and it is consistent with the already established fact that infections (including LRTI) occur more frequently in the presence of a low CD4 T cell count among people living with HIV (PLWH). This is due to the fact that CD4 T cells play a key role in achieving a regulated effective immune response to pathogens (24).

Similarly, we also found a significant association between cigarette smoking and the

development of LRTI. This is consistent with earlier studies that have shown cigarette smoking to be associated with a high rate of pneumonia even across all strata of CD4 T cell count (23,25).

Our study observed no significant association between the use of co-trimoxazole prophylaxis and the development of LRTI. This is contrary to earlier studies that have demonstrated a reduction in the frequency of LRTI and the associated mortality with the use of co-trimoxazole prophylaxis (23). The reason for this finding may be due to the fact that the patients were followed-up for only a period of one year and this may have been inadequate to demonstrate the effect of the use of co-trimoxazole prophylaxis.

CONCLUSION

This study has shown that LRTI is common among PLWH in Osogbo, Nigeria, and it occurs more frequently in those with low CD4 T cell count (<200 cells/mm³) and those with a history of cigarette smoking. We recommend the incorporation of smoking cessation therapies into the care of PLWH and an increased surveillance for LRTI in this category of people, particularly those with a low CD4 T cell count.

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Conflict of Interest: There are no conflicts of interest.

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Table 1: Basic characteristics of respondents

Socio-demographic profile	Frequency (n) n=122	Percentage (%)
Age (in years) Mean±SD	41.9±10.02	
Sex		
Male	35	28.7
Female	87	71.3
BMI		
Underweight	8	6.6
Normal weight	84	68.9
Overweight	19	15.6
Obesity	11	9.0
Mean duration since diagnosis (in years)	3.9±2.84	
CD4 count (cells/mm³)		
<200	25	20.5
200 - 500	64	52.5
>500	33	27.0
Duration on ART (in years) Mean±SD	2.8±2.33	
Currently on co-trimoxazole		
Yes	36	29.5
No	86	70.5
Cigarette smoking history		
Yes	9	7.4
No	113	92.6

Table 2: Occurrence of LRTI in the study participants

Variable	Frequency (n) n=122	Percentage (%)
Pneumonia	4	3.3
Probable Pneumonia	13	10.7
None	105	86.1
Development of LRTI		
Yes	17	13.9
No	105	86.1

Table 3: Relationship between the patients' characteristics and the development of LRTI

Variables	Development of LRTI		Test statistics	P-value
	Yes n(%) n=17	No n(%) n=105		
Age (in years) Mean±SD	42.9±10.08	41.7±10.04	t = 0.456	0.649
Sex				
Male	6 (17.1)	29 (82.9)	$\chi^2=0.421$	0.516
Female	11 (12.6)	76 (87.4)		
BMI (Kg/m²)				
Underweight	3 (37.5)	5 (62.5)	$\chi^2=4.343$	0.227
Normal weight	10 (11.9)	74 (88.1)		
Overweight	2 (10.5)	17 (89.5)		
Obesity	2 (18.2)	9 (81.8)		
Mean duration since diagnosis (in years)	3.1±2.65	4.0±2.86	t = -1.237	0.219
CD4 count (cells/mm³)				
<200	7 (28.0)	18 (72.0)	LR $\chi^2=7.930$	0.019
200 - 500	9 (14.1)	55 (85.9)		
>500	1 (3.0)	32 (97.0)		
Mean Duration on ART	2.5±2.59	2.8±2.30	t = -0.626	0.533
Currently on *CTX				
Yes	5 (13.9)	31 (86.1)	$\chi^2=0.000$	0.993
No	12 (14.0)	74 (86.0)		
Cigarette smoking history				
Yes	7 (77.8)	2 (22.2)	Fisher's exact test	0.000
No	10 (8.8)	103 (91.2)		

*CTX = Co-trimoxazole,