Prevalence of pulmonary tuberculosis (PTB) among people living with HIV/AIDS (PLWHA) in Keffi and its environs

Grace R. Pennap · Joseph N. Giyan · Angela T. Eleboda

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Abstract Coinfection with HIV and *Mycobacterium tuberculosis* is known to be a lethal combination especially with its attendant mortality and morbidity. The need to have a baseline data in an environment like Keffi with a HIV/AIDS prevalence of 38.6% necessitated this study. Three hundred and ninety people living with HIV/AIDS (PLWHA) were screened for pulmonary tuberculosis. Results of this study showed 16.7% prevalence of coinfection in the population. Gender-related prevalence of coinfection was 19.4% and 14.4% among males and females respectively ($P>0.05$). Age-related prevalence of coinfection was least among respondents of age below 20 years (13.3%) and highest among those of age above 40 years (20.2%) ($P>0.05$). Even though statistically insignificant by both parameters, these findings are of public health significance. There is therefore an urgent need for immediate intervention to allow for early TB diagnosis, institution of anti-TB treatment and provision of prophylaxis against TB among TB-negative PLWHA.

Keywords HIV · Pulmonary tuberculosis · Coinfection · PLWHA

Introduction

Infection with *Mycobacterium tuberculosis* and human immunodeficiency virus (HIV) leading to tuberculosis (TB) and HIV/AIDS respectively has been noted as a lethal combination [1]. Of the 14 million people coinfecting, 10 million live in Africa while 70% of them live in sub-Saharan Africa [2]. HIV infection is the most potent risk factor for converting latent TB into active transmissible TB, thus accelerating the spread of the disease. Conversely, *M. tuberculosis* helps accelerate the progress of HIV, thereby increasing morbidity, mortality and the frequency of opportunistic infections [3, 4]. Coinfection with TB has also been reported to result in more rapid deterioration of immune dysfunction, viral replication and progression of HIV [5] although TB may also be a direct cause of mortality [3, 5] accounting for 2 million deaths each year. While TB has been singled out as the most important opportunistic infection in HIV/AIDS mainly because of its highly infectious nature [1], HIV has also been reported to have a significant effect on the risk of TB relapse [6]. HIV infection can increase the risk of developing TB by 50% and is a primary driver in the global increase in TB prevalence and multidrug resistant TB [7].

Ninety-five percent of all TB cases are found in the developing world [8] and has been reported as the leading cause of death among people living with HIV infection, accounting for 33% of deaths due to AIDS [9]. While some individuals die of late diagnosed TB, others die from HIV-related complications [7]. Despite the fact that TB is curable, factors such as coinfection with HIV, emergence of multidrug resistant tuberculosis, poverty, malnutrition, overcrowding and increasing numbers of displaced persons contribute to its resurgence and problematic control in developing coun-

G. R. Pennap¹ (✉) · J. N. Giyan² · A. T. Eleboda²

¹Department of Biological Sciences,
Nasarawa State University Keffi

²Sexually Transmitted Diseases Clinic,
Federal Medical Center Keffi

E-mail: rinmecit.grace@yahoo.com

tries [6]. However, in environments with a high prevalence of TB, preventive therapy against it for people infected with HIV offers protection against it although with no effect on HIV progression or mortality in cases where highly active antiretroviral therapy has not commenced [10, 11].

In Nigeria, some AIDS treatment centers have reported HIV/TB coinfection [12, 13]. TB has also been reported as a leading cause of morbidity and mortality among people leaving with HIV/AIDS (PLWHA) in Nigeria [14]. The prevalence of this important opportunistic infection has not been reported for Keffi and its Environs. This therefore necessitated this baseline study.

Materials and methods

Study population

This study was done in a hospital and the target populations were PLWHA. Blood samples were collected from patients who reported to the Sexually Transmitted Diseases Clinic of Federal Medical Center, Keffi who took the HIV test or voluntary HIV screening. Sputum samples were further collected from those who tested positive for HIV. Demographic information about each person was obtained. Such information included age, gender and address.

Human immunodeficiency virus detection

A World Health Organisation (WHO) approved kit manufactured by Abbot Laboratory called “Determine” was used for detecting HIV. It is a qualitative immunoassay for the detection of antibodies to HIV-1 and/or HIV-2 in human serum and plasma. It is made up of strips impregnated with selenium colloid HIV antigen conjugate at one end and two reaction windows at the other. The kits were stored at 4°C until ready for use. Screening of the specimen was carried out as recommended by the manufacturer.

Test procedure

The test kit was brought to room temperature and the protective foil cover was removed from each strip before use. The test sera collected were also brought to room temperature. Using a microtitre pipette, 50 µl of each test serum sample was introduced on to a separate test strip and left to stand for 15 min at room temperature. The result of the test was read visually.

Interpretation of results

When two red bars appeared in both control and patient windows of the strip, the result was interpreted as posi-

tive. However, the appearance of only one red bar in the patient’s window of the strip was interpreted as negative while the absence of a red bar in the control and patient’s windows was interpreted as invalid and therefore repeated.

Pulmonary tuberculosis (PTB) detection

Sputum smear microscopy test for acid fast bacilli (AFB) using the Ziehl-Neelsen staining technique to test for the presence of *M. tuberculosis* was employed.

A thin smear of the specimen was made on a clean glass slide using a sterile wire loop and air dried. The fixed smear was placed on a staining rack, flooded with carbol fuchsin stain (primary stain) and heated until vapor began to rise. The slide was rinsed with acid alcohol for 2 min until the smear became pale pink. The slide was further rinsed with clean running tap water and counterstained with methylene blue (secondary stain) for 2 min. The slide was again rinsed with water and allowed to dry. A drop of immersion oil was placed on the dried slide and viewed under the 100X objective lens of the microscope. In order to detect the elusive acid fast TB bacterium, each slide was examined using different microscopic fields over a 10-minute period. AFB appeared as red rods (bacilli) against a dark background and a result was recorded as a “smear positive case of pulmonary tuberculosis” when AFB was detected in two of the three samples collected.

Statistical analysis

The chi-square test was employed to determine the association between HIV/PTB infection with gender and age.

Results

The study population comprised 390 HIV-positive individuals who were all screened for *M. tuberculosis* infection. Of these, 65 tested positive to Ziehl-Neelsen staining technique for AFB. The prevalence of infection in the study population was 16.7%. The gender-related prevalence of PTB among males and females was found to be 19.4% and 14.4% respectively (Table 1). There was no statistically significant relationship between gender and the bacterial infection ($P>0.05$). Age-related prevalence of infection showed that the highest prevalence of infection (20.2%) was in the age group above 40 years. The least prevalence of infection (15.2%) was recorded in those less than 20 years of age (Table 2). The difference in the prevalence of infection among the various age groups was statistically insignificant ($P>0.05$).

Table 1 Prevalence of pulmonary tuberculosis in relation to gender among PLWHA in Keffi and its environs

Gender	Number examined	Number positive	Prevalence (%)
Male	175	34	19.4
Female	215	31	14.4
Total	390	65	16.7

Table 2 Prevalence of pulmonary tuberculosis in relation to age among PLWHA in Keffi and its environs

Age (years)	Number examined	Number positive	Prevalence (%)
<20	45	6	13.3
21–30	151	23	15.2
31–40	120	21	17.5
>40	74	15	20.2
Total	390	65	16.7

Discussion

HIV screening was carried out with an antibody-based ELISA detection technique which detects both HIV-1 and HIV-2. This implies that the HIV-positive individuals in this study include those with HIV-1 and/or HIV-2 infections. The prevalence of PTB infection was 16.7% among PLWHA although in recent studies, researchers observed that most HIV-infected individuals were co-infected with PTB [8].

Generally, PTB diagnosis is known to be notoriously difficult in those with HIV [4, 15], raising the possibility that some of them with early or subclinical *M. tuberculosis* infection were not detected. A central limitation is that most diagnostic tools, which include the sputum smear microscopy used in this study, focus on TB in the lungs, thus hunt for bacilli in the patient's sputum. Culturing of infected tissues or fluid from an individual diagnose TB with far greater accuracy, even among HIV-infected people. The disadvantage is that cultures are time-consuming especially for coinfecting PTB/HIV patients who may die while waiting for the result. The basis of AFB tests despite its limitation is to enable the initiation of empiric therapy for tuberculosis which is known to be curable if properly handled.

The reported statistically insignificant difference in the prevalence rates of TB/HIV coinfection in relation to age and gender might have been because HIV generally destroys the human immune system, paving the way for opportunistic infections especially TB. It has also been described as a primary driver in the global increase in tuberculosis prevalence [7] and has a significant effect on the risk of developing tuberculosis [6]. Therefore, it does not

matter whether it is male or female. Thus the difference in prevalence is insignificant.

Although the incidence of TB varies with age [16] the difference in prevalence of coinfection among the various age groups of PLWHA in the study area was also not statistically significant. This is simply because HIV weakens the immune system of every individual, thereby making the HIV-positive individual easily susceptible to the bacterial infection irrespective of age.

Conclusion

The 16.7% prevalence of co-infection with PTB among PLWHA in the study area is of public health significance. There is need for immediate intervention especially with reports that tuberculosis is a leading cause of mortality and morbidity among HIV/AIDS patients in Nigeria [14]. It is therefore imperative in this area where HIV seroprevalence is as high as 38.6% [17]. TB screening at Voluntary Counseling and Testing (VCT) centers should be aggressively pursued. This is to allow for early institution of anti-TB treatment and provision of prophylaxis against tuberculosis among HIV-infected individuals who are not yet infected with the bacterium. This can greatly prolong the life span of the infected by reducing both the speed at which full-blown AIDS occurs and increasing the ability to live long and have effective lives. This in turn will delay the effect even at the household level.

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