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Tuberculosis/HIV Co-infection among Internally Displaced Persons (IDP) in Gombe State, Nigeria

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Authors' contributions

This work was carried out in collaboration among all authors. Author LM was involved in study design, data collection and manuscript writing. Author KM supervised data collection process and study design. Author GI was involved in manuscript revision and designed the data collection form. All authors read and approved the manuscript.

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ABSTRACT

Background: Tuberculosis is a global health problem associated with high morbidity and mortality. Rapid diagnosis of tuberculosis is essential for early disease management. Human Immunodeficiency Virus (HIV) is a virus that gradually attacks the immune system and the immune system is our body's natural defence against illness. Co-infection of TB and HIV is when someone has both HIV and TB infections. This study determined the TB/HIV Co-infection among IDP's.
Methodology: A total of 130 sputum samples from suspected tuberculosis patients were examined from August 2020 to September 2020.
Result: Fifty-nine patients 59(45.4%) were males and seventy-one 71 patients (54.6%) were females. Seventeen patients (13.07%) had tuberculosis. Ten (10) cases of the TB patients were found to be co-infected with HIV. The CD_4^+ cell count of the TB/HIV co-infected patients falls below 250 cells/mm^3 compared to the mono-infected patients who had CD_4^+ above 250 cells/mm^3.
Conclusion: This study showed that TB/HIV coinfection was associated with age group 21-40 years was high.

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Keywords: Tuberculosis; HIV; coinfection; CD4+ cells IDP and Gombe State.

ABBREVIATIONS

TB : Tuberculosis
HIV : Human Immunodeficiency Virus
CD_4 : Cluster of Differentiation 4
SPSS : Statistical Package for the Social Sciences
P value : Probability Value
X^2 : Chi Square

1. INTRODUCTION

Pulmonary tuberculosis (TB) is a chronic infectious disease caused by *Mycobacterium tuberculosis* [1]. The mycobacteria can also produce pulmonary TB and these include *Mycobacterium africanum* and *Mycobacterium bovis.* Usually, patients with pulmonary TB who have cavitary lesions are an important source of infection. These patients are usually sputum smear-positive. Coughing produces tiny infectious droplets. Usually, one bout of cough produces 3000 droplet nuclei and these can stay in the air for a long period of time. Ventilation removes these infectious nuclei. *Mycobacterium tuberculosis* can survive in the dark for several hours. Direct exposure to sunlight quickly kills these bacilli. Of the several factors, determining an individual's risk of exposure, two factors are important. These include the concentration of droplet nuclei in contaminated air and the length of time that air is breathed. The risk of transmission of infection from a person with sputum smear-negative pulmonary TB is low and with extra-pulmonary TB is even lower. However, infection with *Mycobacterium bovis* is rare in India because milk is often boiled before use. Even though non-tuberculous mycobacteria [NTM] are harmless, some can cause human disease especially in immunocompromised individuals [2]. *Mycobacterium Tuberculosis* **(**MTB) is regarded as an etiologic agent of tuberculosis (TB) with the identification feature of the organism as been an acid–fast bacillus [3]. Tuberculosis is a leading health problem worldwide and remains one of the leading causes of death from infectious disease. It is a highly infectious disease that is widely distributed throughout the globe [4]. Almost one third of the world's population is infected with *Mycobacterium tuberculosis* and the majority of these individuals live in less developed countries [5]. It is commonly a disease of the lung where it forms a localized infection after inhalation. Worldwide, TB is responsible for more than 1.5 million deaths every year, [6] with an estimated rate of 13.7 million prevalent cases in 2007 (206 per 100,000 populations) [7]. Therefore, despite recent progress, TB remains a global public health challenge [7]. *Mycobacterium tuberculosis* infects 1:3 persons worldwide and kills more people each year than any other bacterial pathogen [8]. TB poses significant challenges to developing economies as it primarily affects people during their most productive years especially in the developing countries with more than 90% of new TB cases and deaths [9].

World Health Organisation (WHO) estimated that Nigeria records 210,000 new cases of all forms of TB in 2010, equivalent to 133/100,000 population, with 90,447 cases notified and 41, 416 (58%) cases as new smear positives, and a case detection rate of 40% [10]. Human Immunodeficiency Virus (HIV) is a virus that gradually attacks the immune system and the immune system is our body's natural defence against illness. If a person becomes infected with HIV, he or she will find it hard to fight off infections and diseases. The virus destroys a type of white blood cell called T-helper cells and makes copies of it inside them. T-helper cells are also referred to as CD4 cells [11]. Co-infection of TB and HIV is when someone has both HIV and TB infections. When someone has HIV and TB, HIV infection accelerates the activation of tuberculosis and tuberculosis increases the rate at which HIV infection develops into AIDS [12]. It is worthy of note that HIV infection and infection with TB bacteria are two different infections as established in [13].

Co-treatment of HIV related TB improves survival especially in patients with CD4 counts <50 ells/mm^3 [14].

2. MATERIALS AND METHODS

2.1 Study Area

The study was conducted in Infectious Diseases Hospital Zambuk Gombe from October 2018 to November 2018.

2.2 Study Design

This is a cross sectional study of persons suspected to have pulmonary tuberculosis. The study involves the use of ZN Staining

method and TB culture (LJ medium) and GeneXpert (PCR) for the diagnoses of TB in persons suspected of having pulmonary tuberculosis.

2.3 Study Population

Internally Displaced Persons from Internally Displaced Persons (IDP) camps in Gombe State.

2.4 Inclusion Criteria

1. Internally Displaced Persons suspected to have pulmonary tuberculosis
2. No history of receiving anti-tuberculous drug within 3 months prior to enrollment.

2.5 Exclusion Criteria

Persons diagnosed with TB and non-IDP were excluded from the study.

2.6 Sample Size Determination

In the calculation of sample size, Prevalence (P) of PTB of 8% was used (NTBLCP, 2017). Hence, the following formula was used.

$$N = Z2\ pq/\ d2$$

Where

N = number of samples
Z = level of significant at 95% confidence interval (1.96)
P = prevalence rate
Q = 1-p
D = tolerable margin of error (5%) = 0.05

$$n = Z2\ pq/\ d2$$

Hence, 130 persons with clinical manifestation of TB were used in this study.

2.7 Sampling Technique

A purposive sampling technique was used to select the participants. The study participants who met the inclusion criteria were selected, examined and interviewed. Informed consent was obtained before enlisting.

2.8 Specimen Collection

Sputum samples were collected in a wide-mouth container, and blood samples were collected in an EDTA container for HIV test and CD4 determination.

2.9 GeneXpert Assay

Procedure: The sputum was mixed with the reagent provided with the assay and was allowed to stay for 15 minutes. The cartridge containing this mixture was placed in the GeneXpert machine. All processing from this point on was fully automated [15].

2.10 Cytoflow Counter

Procedure: Five (5 mls) of blood samples were collected by vene-puncture into EDTA tubes. Twenty microliter (20 µl) whole blood was placed into the rohren test tube, then twenty microliter (20 µl) of CD^{+}_{4} mAb PE was added to the blood sample and was mixed gently and incubated for 15 minutes at 37^{0}C in the dark. Eight hundred microliter (800 µl) of no lyse buffer was added to the mixture and was vortex gently. The mixture was then inserted onto the sample port and the start button was clicked. The measurement started automatically as the operating software indicated the Pre-run, Run and Count Status [16].

2.11 HIV Testing Methods

The Geenius™ HIV 1/2 Confirmatory Assay employs antibody binding protein A, which is conjugated to colloidal gold dye particles as conjugate and HIV-1 (p31, gp160, p24, gp41) and HIV-2 antigens (gp36, gp140), which are bound to the membrane solid phase. The sample is applied to the SAMPLE + BUFFER well. After the sample and buffer have migrated onto the test strip, additional buffer is added to the BUFFER well. The buffer facilitates the lateral flow of the released products and promotes the binding of antibodies to the antigens.

2.12 Materials Required

Device (20 units), Buffer Dropper (1 x 5 ml) and Microtubes 15 µl (1 x 20) per kit. timing device. Pipettor capable of delivering 5 µl (serum/plasma) and 15 µl (venous blood) of sample.

- Disposable gloves.
- Biohazard disposal containers.

2.13 Assay Procedure

- Remove the Geenius™ HIV 1/2 Confirmatory Assay device from its pouch and place it on a flat surface Label the test device with patient identification number.
- 15 ul of whole blood sample was added to the buffer + sample well 1 and

immediately, 2 drops of buffer were added to the same well 1.

- After 5 minutes, 5 drops of buffers were added to the buffer well 2.
- After 20 minutes the result was read [17].

3. RESULTS

The prevalence of TB based on demographic characteristics of the study population showed that 16.9% of males and 9.85% females had TB, 4.54% of the age group of less than 20 years, 10.3% of 21-40 years and 21.2% of 41-60 years have TB. Among which 15.3% were married, 13.2% are singles. There is no statistically significant difference in the prevalence of TB based on age P>0.005 (Table 1).

The prevalence of HIV among suspected TB patients based on demographic variables. This indicated that male have the highest prevalence of 23.7% and female have 11.2% based on Gender (Sex). Based on marital status, the married have the highest prevalence of 21% while the singles and the widows had 0.00%. This further showed that the age group of 41-60 years had the highest prevalence of 21.2% followed by 21-40 years with 15.5%. There is statistically significant difference in the prevalence of HIV among suspected TB patients P<0.05 (Table 2).

Out of the 17 TB confirmed patients 4(66.6%) females and 6(54.5%) males had co-infection with HIV. The married had 10(71.4%) co-infection and the ae group of 21-40 years had the highest prevalence of co-infection with 100% followed by the age group 41-60 with 54.5%. There is no statistically significant difference in the prevalence of TB/HIV co-infection based on the age group (Table 3).

Table 1. Prevalence of tuberculosis based on demographic characteristics of the patients

Variables	No. of samples examined	No. of positive samples	% of positive sample	p-value
Gender				
Female	71	8	11.2	0.00
Male	59	14	23.7	
Marital status				
Married	113	21	18.5	0.00
Single	13	0	0.00	
Widow	4	0	0.00	
Age groups				
Under 20	22	0	0.00	0.05
21-40	58	9	15.5	
41-60	47	10	21.2	
60 and older	3	2	66.6	

Key: TB= Tuberculosis, P-Value= Probability value

Table 2. Prevalence of HIV among suspected TB patients based on demographic variables

Variables	Number of samples examined	No. positive to TB	% Prevalence	p-value
Gender				
Male	59	10	16.9	0.00
Female	71	7	9.85	
Age group				
≤20	22	1	4.54	0.150
21-40	58	6	10.3	
41-60	47	10	21.2	
>60	3	0	0.00	
Marital Status				
Single	13	2	15.3	0.00
Married	113	15	13.2	
Widow	4	0	0.00	

Key: HIV= Human immunodeficiency virus, TB= Tuberculosis, p-value= Probability Value

The CD_4^+ cell count of patients with only TB infection shows 11.8% had CD_4^+ of less than 50 cells/mm^3, 23.5% had CD_4^+ count of 51-250 cell/mm^3, 52.9% had CD_4+ count of 251-500 cell/mm^3 and 11.8% had CD_4^+ of above 500 cell/mm^3. Also, patients with HIV infection only showed 4.5% had CD_4^+ of less than 50cells/mm^3, 36.3% had CD_4^+ of 51-250 cell/mm^3, 45.5% had CD_4^+ count of 2511-500 cells/mm^3 and 13.6% had CD_4^+ of 500 cell/mm^3 above. Patients with TB/HIV coinfection showed that 20% had CD_4^+ of less than 50cells/mm^3, 70% had CD_4^+ count of 51-250cells/mm^3 and 10% had CD_4^+ count of 251-500cells/mm^3 (Table 4).

4. DISCUSSION

The prevalence of TB in this study is high in aged 41-60 years (21.2%). This is in agreement with the findings of Okonkwo [18] but contrary with the report by Sani [19] who presented a higher prevalence in a lesser group age. The observed prevalence of TB in the age group 41-60 years may be attributed to the fact that they practice a social habit of eating in groups. Tuberculosis being a respiratory infection, is spread from person to person via contaminated air, nasal secretion etc.

The age group below 15 years have 4.45% TB prevalence, this can be linked to the age group's literacy. The incorporation of hygiene practices in their school's curriculum in the levels of primary and secondary school may allow them to effectively receive educational information on MTB prevention from schools and the mass media.

In this study, prevalence in relation to gender, males were shown to have the highest prevalence of TB (16.9%) than the females (9.85%). This result is in agreement with report by Sani [19] in Niger state, but is contrary to the report by Nwachukwu [20] who stated that females have the highest prevalence of tuberculosis in Abia state. The observed high prevalence of TB in males could be as a result of behavioral attitude and the indiscriminate use of drugs and its abuse.

This study showed that TB/HIV coinfection was associated with age group 21-40 years with (100%), this can be attributed to the fact that they are sexually active, and therefore meeting sexual partners in whom MTB and HIV are both prevalent. This is contrary to what was reported by Olusola [21] in Lagos, who stated that TB/HIV

Table 3. Prevalence of HIV among Tuberculosis patients (coinfected) in IDP camps in Gombe

Variables	No. of TB patients examined	No. and % of TB patients without HIV	No. and % of patients with HIV	p-value
Gender				
Female	06	02(33.3)	04(66.6)	0.00
Male	11	05(45.5)	06(54.5)	
Marital status				
Married	14	4(28.5)	10(71.4)	0.00
Single	1	1(100)	0(0.00)	
Widow	2	2 (100)	0(0.00)	
Age groups				
Under 20	1	1(100)	0(0.00)	0.150
21-40	4	0(0.00)	04(100)	
41-60	11	5(45.5)	06(54.5)	
60 and older	1	1(100)	0(0.00)	

Key: HIV= Human immunodeficiency virus TB= Tuberculosis p-value= Probability Value, IDP= Internally Displaced Persons

Table 4. CD_4^+ count in patients with tuberculosis, HIV and TB/HIV Coinfection

No. of samples	No. of TB positive samples (%)	No. of HIV positive samples (%)	No. of TB/HIV co-infected samples (%)	CD_4^+ counts cell/mm^3
17	2(11.8)	1(4.5)	3(20.0)	<50
17	4(23.5)	8(36.3)	6(70.0)	51-250
17	9(52.9)	10(45.5)	1(10.0)	251-500
17	2(11.8)	3(13.6)	0(0.00)	500 Above

Key: CD= Cluster of Differentiation, TB= Tuberculosis, HIV= Human immunodeficiency virus

co-infection was associated with the age group above 40 years and is in agreement with the findings by Onyebuchi [22] in Abuja. Who reported that TB/HIV co-infected patients are three times likely to have extrapulmonary TB (EPTB) than pulmonary TB.

This study also revealed the determinants of TB/HIV co-infection among TB-positive patients. HIV (17.6%), Low CD_4 count, Malnutrition (13.8%), and Overcrowding (15.3%) were independent predictors of TB/HIV co-infection among TB-positive persons. As CD_4+ lymphocyte count decreases the body defense mechanism will be overwhelmed by various opportunistic infections. The results showed that, patients with CD_4 T-lymphocytes count less than 250 cells/mm^3 were about 2 times more likely to develop TB as compared to CD_4 T-lymphocytes count more than 250 cells/mm^3. In this study TB patients had CD_4 cell count of 52.9% as the highest CD_4 count in the range of 251-500cells/mm^3 and the least is 11.8% of the CD_4 range less than 50cells/mm^3. Among the HIV patients, the highest CD_4 cells obtained was 45.5% of the range 251-500cells/mm^3 and the least was 4.5% of less than 50cells/mm^3. The coinfected patients highest CD_4 count of 70% of the range 51-250 and the lowest is 10% of the CD_4 range 251-500 cells/mm^3. This is in conformity that lower CD_4+ lymphocyte count was observed in co-infected patients than mono infected patients stated by Agbaji [23].

5. CONCLUSION

The study showed that whenever HIV is present, the patient may likely be infected with TB if adequate care is not given. Early detection of HIV and TB cases leads to proper control of the disease.

CONSENT AND ETHICAL APPROVAL

Ethical approval was obtained from the Ethics and Research Committee of the Ministry of Health, Gombe for permission to conduct the study. The ethical approval reference number is MOH/ADM/S/658/VOL.11/112. The research was conducted in conformity with the standard of human experimentation and with the Helsinki Declaration of 1975, as revised in 2000. Patient information was treated with utmost confidentiality. The Study participants bears no financial burden. Informed consent was obtained from all participating subjects in the IDP using standard protocol after the objectives and the procedures were explained to the participants.

DECLARATIONS AVAILABILITY OF DATA AND MATERIALS

The dataset used in this study are available from the corresponding author based on reasonable request.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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