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Prevalence of Tuberculosis in HIV infected patients

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ABSTRACT:

The prevalence of tuberculosis (TB) in human immunodeficiency virus (HIV) infected persons visiting an infectious disease hospital in Port Harcourt, Nigeria was investigated. A total of 500 patients between the ages of 1 to 50 years and above were screened. Determine and Stat-Pak™ test kits were used to determine the presence of HIV antibodies in serum samples (Enzyme Linked Immunosorbent Assay - ELISA). While the Ziehl Neelson's staining technique was used to determine the presence of acid fast bacilli (bacteriologically confirmed cases of sputum smear-positive tuberculosis). The results showed that 45.53% of the males and 53.96% of the females were HIV sero-positive. At the end of the screening 16.8% of all the cases were found to be bacteriologically confirmed cases of sputum smear-positive tuberculosis. The prevalence rate of tuberculosis among the males was 17.9% while its rate among the females was 15.9%. The HIV/TB co-infection rate in males and females was 19.6% and 18.2% respectively. While in all the cases, the HIV/TB co-infection rate was 18.8%. Of the HIV sero-positive subjects, the highest rate (27.3%) was recorded in persons of 50 years and above. These findings are attributed to the poor quality of life, illiteracy, social habits and lack of adequate sanitary condition and health care. Since low standard of living is a risk factor for TB and as a result of the HIV pandemic. It is necessary for all new TB patients to be screened for HIV infection and *vice versa*.

Key words: Tuberculosis,HIV, Infectious disease, Infections.

INTRODUCTION:

Tuberculosis is a disease, which affects mainly the lungs and is transmitted exogenously, when *Mycobacterium* pathogens are inhaled or acquired from the environment as droplets or from infected individuals when they sneeze or cough. Tuberculosis can also be transmitted from a mother to her child before and after birth.

However, most infections of babies are caught after birth due to close contact between an infected mother and her baby. Thus anyone living with an infected person in the same house is at risk of tuberculosis infection and screening is recommended for the whole family as well as preventive therapy. The vast majority of *Mycobacterium avium* complex infections as well as *M. tuberculosis* infections in normal people are asymptomatic. However, in elderly people and other immunodeficient people, especially those with underlying lung diseases, a chronic cough develops that last 3 weeks or longer. There is pain in the chest, hemoptysis or coughing up blood, coughing up sputum, fatigue, weight loss, loss of appetite, chills, low grade fever and night sweats. Local symptoms are also present, but depend on the part of the body affected.

Active pulmonary tuberculosis is chronic if untreated and leads to progressive destruction of lung tissue. Cavities formed in the lungs erode into pulmonary blood vessels resulting in life threatening hemorrhage. General health and nutritional status deteriorates culminating in death due to wasting infections or multiple organ failure. Varied syndrome such as lymphadenitis in children is caused by organisms of the *Mycobacterium avium/intracellulare* complex (MAIC), which in immunocompetence does not arise due to protective immunity conferred on the individual by infection with *M. tuberculosis* infection. Tuberculosis is estimated to cause at least three million deaths per year worldwide and also accounts for more than one-quarter of all preventable adult deaths in developing countries. [1]

Human Immunodeficiency Virus (HIV) is a retrovirus identified as the aetiologic agent for Acquired immunodeficiency Syndrome (AIDS). [2] The major routes of transmission are genderual contact, contamination by blood or blood products and mother-to-newborn transmission. [3-4] In HIV infected patients tuberculosis is caused by *Mycobacterium tuberculosis* as well as *M. avium* and *M. Intercellulare* which are non-pathogenic in non-HIV infected patients. This is because HIV which causes the Acquired immunodeficiency Syndrome (AIDS) robs the body of its natural ability to fight infections thus making people with AIDS more likely to develop tuberculosis. One cause of deterioration may be activation of HIV replication when HIV-infected macrophages are infected with *Mycobacterium avium* complex - this complex consist of *M. avium* and *M. Intracellulare*. [5] In HIV infected patients the disease spreads throughout the body system and may be fatal if adequate treatment is not given.

Infection with HIV is thought to be the single most important factor that has contributed to the increased incidence of tuberculosis globally in the last decade. Tuberculosis is now the leading cause of death among HIV-infected individuals worldwide and accounts for at least 40% of deaths among HIV-infected persons in Africa. [6]

It has been reported that Nigeria particularly has been one of the countries worst affected by tuberculosis and HIV epidemics especially in the past 10 years. Nigeria currently ranks 4th among countries with highest tuberculosis burden in the world.

The rate of spread of tuberculosis in most developing countries including Nigeria is due to the poor quality of life, low education level and lack of adequate sanitary condition and health care. Thus, the occurrence of TB may negatively affect the course of HIV-infection and that whatever strategies that would lower the incidence of TB may also have an important impact on the survival of HIV-infected patients in areas with high prevalence of *M. tuberculosis* infection.

The high rates of these diseases have affected Nigeria's economy negatively. Per capita expenditure on health is about 35,000 dollars annually. In 2000, Nigeria devoted about 3.1% of her income on health. In February 2001, Nigeria launched an ambitious HIV/AIDS emergency plan (HEAP) and the estimated cost of the program was 182 million dollars. Out of this, Nigeria committed 54 million dollars while the rest were donated by other organizations. [6]

Patients who are co-infected with HIV and *Mycobacterium tuberculosis* are at high risk of active TB. [7] In developing countries such patients add to the load of strained TB programs. Although the effect of HIV on the TB epidemic is extensively documented in sub-Saharan Africa less is known about its effect in Port Harcourt, Nigeria. [8]

Port Harcourt is the capital of Rivers State, a cosmopolitan city, with a population of about five hundred and forty one thousand, one hundred and eighteen. [9] The city is centrally located and has many multinational companies located in it. In-fact, it is the centre of crude oil production and business in Nigeria. Port Harcourt has a good population representation of all the states in Nigeria as well as non-Nigerians and expatriates, making it a very good study area.

The objectives of the study are to determine the prevalence of HIV infection Port Harcourt Metropolis, to ascertain the co-infection of HIV infection and tuberculosis; to ascertain the age and gender that is most affected and the risk factors that makes people more vulnerable to the infection, and to advocate a strong strategy that will help to control the spread of HIV and tuberculosis.

MATERIALS AND METHODS:

Study Area and Source of Patients' samples

Samples for the investigation were collected from 500 (five hundred) patients who attended the Niger hospital between June and August 2007. The Niger Hospital is located in *Diobu* the central and most populated area of Port Harcourt metropolis. Niger

hospital is the major Infectious Disease Hospital (IDH) and main centre for the diagnosis and treatment of tuberculosis and sexually transmitted diseases. It caters for the needs of Port Harcourt metropolis and its environs and Rivers State in general.
Ziehl Nelson method for diagnosis of acid fast bacilli (*Mycobacterium tuberculosis*) in sputum samples was used together with HIV serological assay using two (2) simple rapid test kits namely – "Determine" (which is very sensitive) and Stat Pak (which is very specific for HIV).

Sputum Sample collection

Sputum samples were collected from HIV patients especially those with cough that had lasted for more than three weeks persistently, having blood stained sputum, weigh loss, prolonged tiredness etc. which are indicative of tuberculosis infection and also from non-HIV infected patients with or without the symptoms.
Three samples were collected from the patient on two consecutive days. The first sample was collected at the spot when the patient came to the laboratory in the morning; it was called a spot sputum sample. The patient was then given two specimen containers one for sputum early in the morning before brushing and eating and the other after brushing and eating or at the spot on arrival at the laboratory. The sputum sample on receipt usually in the morning was labeled and the data of the patient was collected. The samples are analyzed immediately on arrival in the laboratory.

Diagnosis and Detection of Acid Fast Bacilli in Sputum

The Ziehl Nelson method for diagnosis of acid fast bacilli (*Mycobacterium tuberculosis*) in sputum samples was used. *Mycobacterium tuberculosis* is a highly infectious bacillus. Before the test was carried out therefore, adequate protective clothing such as lab coats, nose masks, hand gloves etc. were worn as protection against self infection.
In the Ziehl Nelson method, heat fixed smears of the specimens are flooded with a solution of carbol fushsin and heated until steam rises. After washing with water, the slide is flooded with a dilute mineral acid (e.g. 3% HCL) and after further washing a blue counterstain such as methylene blue 0.2% (aq.) was applied. The methylene blue stains the backgroung material providing a contrasting colour against which the red AFB can be seen under the microscope. The result is interpreted based on International Union Against Tuberculosis and Lung Diseases (IUATLD) Standard.

Procedure for HIV Serological Assay (Determine kit)

The protective foil cover of the test kit was removed and 50 microliter of serum sample was applied to the sample pad and it was allowed to stand for 15 minutes. The result

was read according to the diagnostic criteria. For whole blood venepuncture samples, chase buffer was added to the sample pad one minute after adding the sample and then it was allowed to stand for 15 minutes before the result was read.

For whole blood finger stick samples, the sample was applied to the sample pad and allowed to get absorbed into the pad, thereafter on drop of chase buffer was added to the pad and results were read after 15 minutes had elapsed.

A result is positive for HIV when both the control line and the test line show pink or red color on application of sample and buffer. This is true for both determine and stat pak kits. While for a negative HIV results, only the control line shows the pink or red coloured line while the test line remains colourless. The result is invalid if no red or pink line shows in both the control and test lines after specimen application or if the pink line shows in the test line without showing in the control. [10]

Procedure for HIV Serological Assay (STAT-PAK™ Kit)

The Stat-Pak™ test device was removed from its pouch and placed on a flat surface and labeled with the patient's name and number. A 5µl sample loop was used to touch the specimen serum allowing the opening of the loop to fill with the fluid. The serum was then dispensed vertically into the center of the sample pad in the sample(s) well of the device. The running buffer was then inverted and held vertically over the sample well and 3 drops of the buffer were added slowly, drop wise into the sample well. The test result was then read after 10 minutes of adding the buffer especially for non-reactive results.

RESULTS AND DISCUSSION:

The result of the incidence (%) of HIV, Tuberculosis, and HIV/TB co-infection in the various groups of subjects is as shown in Figure 1. Results showed that, 45.53% of the males and 53.96% of the females were sero-positive. At the end of the screening 16.8% of all the cases were found to be bacteriologically confirmed cases of sputum smear-positive tuberculosis. The prevalence rate of tuberculosis among the males was 17.9% while its rate among the females was 15.9%. The HIV/TB co-infection rate in males and females was 19.6% and 18.2% respectively. While in all the cases, the HIV/TB co-infection rate was 18.8%.

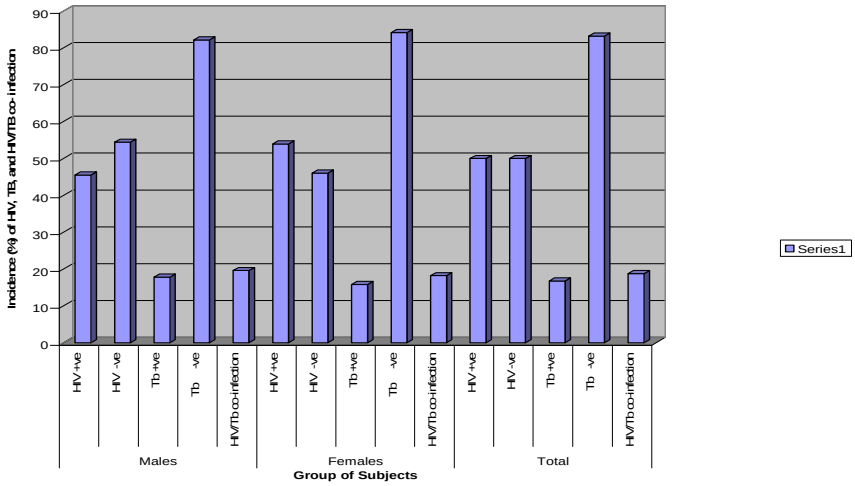

Fig. 1. Incidence (%) of HIV, Tuberculosis, and HIV/TB co-infection in the various groups of subjects

The result of the prevalence of Tuberculosis (%) in gender and age group of HIV sero-positive and HIV sero-negative subjects is as shown in Figure 2. The sero-positive females of 50 years and above had the highest prevalence rate of tuberculosis (27.3%) closely followed by sero-positive males between 15-21 years (25.0%). In all cases, there was no record of tuberculosis in males of between 1 – 14 years. Generally, however, the prevalence of tuberculosis is higher among the males (17.87%) than among the females (15.85%). The prevalence of tuberculosis is higher (18.8%) in HIV sero-positive subjects than in HIV sero-negative subjects (14.8%).

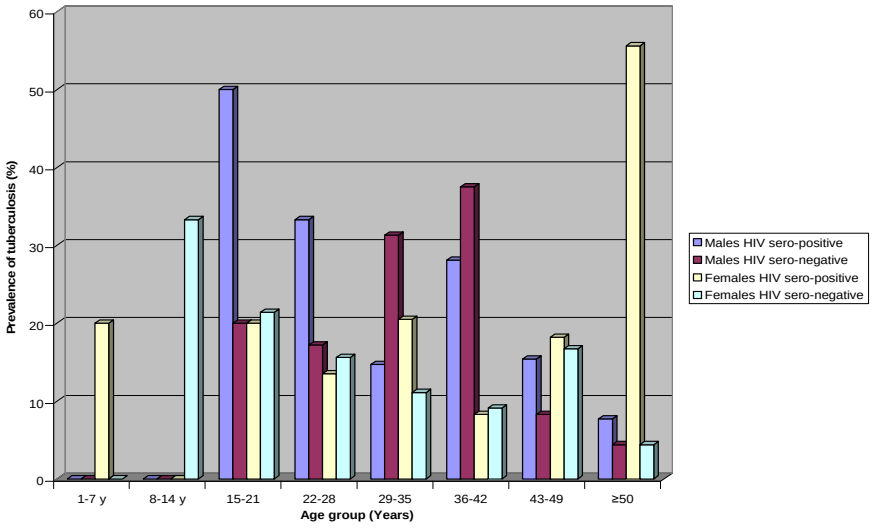

Fig. 2. Prevalence of Tuberculosis (%) in gender and age group of HIV sero-positive and HIV sero-negative subjects

The trend of prevalence of tuberculosis in age groups of HIV sero-positive and HIV sero-negative subjects is as shown in Figure 3. The prevalence of tuberculosis in HIV sero-negative subjects of between the ages of 22 and 42 was higher than in their corresponding HIV sero-positive subjects after which, there was a decrease in prevalence with age as against the prevalence in HIV sero-positive subjects which increased.

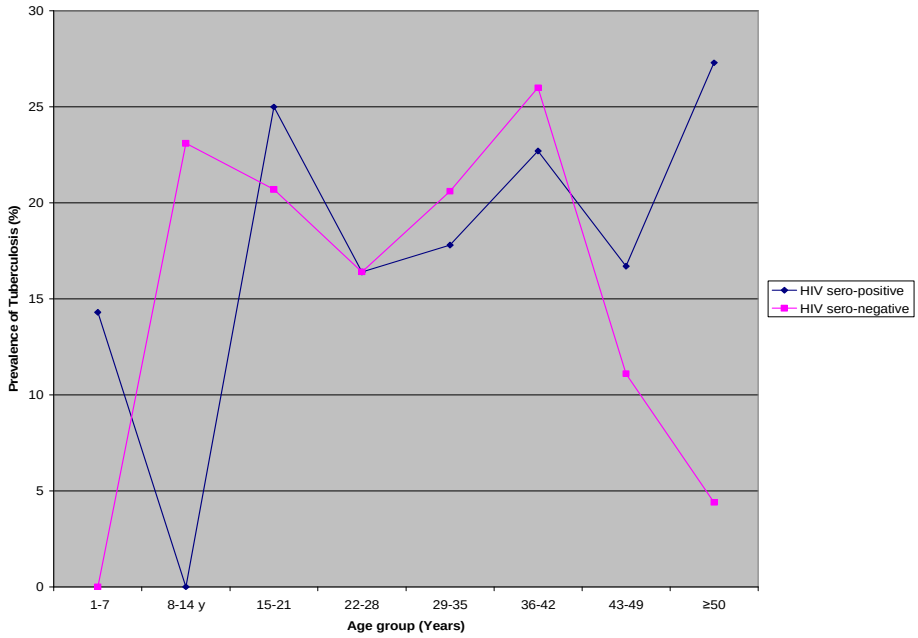

Fig. 3. Prevalence of tuberculosis in age groups of HIV sero-positive and HIV sero-negative subjects

The present investigation has revealed the prevalence of tuberculosis in HIV sero-positive and in HIV sero-negative persons in Port Harcourt, Nigeria. The results showed that 45.53% of the males and 53.96% of the females were HIV sero-positive. At the end of the screening 16.8% of all the cases were found to be bacteriologically confirmed cases of sputum smear-positive tuberculosis. The prevalence rate of tuberculosis among the males was 17.9% while its rate among the females was 15.9%. The HIV/TB co-infection rate in males and females was 19.6% and 18.2% respectively. While in all the cases, the HIV/TB co-infection rate was 18.8%. This co-infection rate of 18.8% is far lower than the 71.4% reported. [11] However, it is quite high when compared to the 3.4% reported in Switzerland. The co-infection rate of 18.8% reported in this study is close to the 19.1% in 2001 reported by National HIV SENTINEL. [6] This study reported

a 16% co-infection rate among high risk groups (15-49 years) as compared to the 27% in 2005 reported by National HIV SENTINEL. [6]

The sero-positive females of 50 years and above had the highest prevalence rate of tuberculosis (27.3%) closely followed by sero-positive males between 15-21 years (25.0%). In all cases, there was no record of tuberculosis in males of between 1 – 14 years. Generally, however, the prevalence of tuberculosis is higher among the males (17.87%) than among the females (15.85%). The prevalence of tuberculosis is higher (18.8%) in HIV sero-positive subjects than in HIV sero-negative subjects (14.8%). The prevalence of tuberculosis in HIV sero-negative subjects of between the ages of 22 and 42 was higher than in their corresponding HIV sero-positive subjects. Thereafter, there was a decrease in prevalence with age as against the prevalence in HIV sero-positive subjects which increased (Fig.3).

This high prevalence rate could likely be attributed to the poor or low standard of living, poor standard of hygiene and bad sanitary habits as practiced by most inhabitants of Port Harcourt metropolis. The low standard of living is believed to be one of the risk factors for the development of tuberculosis.

In this study, the prevalence of tuberculosis was higher in males than in females in both the HIV sero-positive and HIV sero-negative subjects. This is in contrast with studies carried out in Europe, North America, and in Uganda where the prevalence rate was higher in females than in males. This trend was found to be highest in the age group of between the ages of 22 and 40 years. This increased prevalence may be due to the fact that persons of these ages are more sexually active, usually with more than one partner, and indulge in the consumption of alcohol and smoking. These habits lead to reduced immunity causing these persons to develop tuberculosis more easily. The higher prevalence of tuberculosis recorded in the males is due to the fact that males are more involved these habits in Port Harcourt than females.

In this study also, the prevalence of tuberculosis was highest in HIV sero-positive females between the ages of 50 and above. This is in contrast to the report that males were found to present with TB at older ages compared with the females. [11] In this present study, the non-HIV infected subjects had the highest rate between 8 and 20 years of age. In the first case of females over 50 years, the high prevalence rate could be caused by menopausal change, a change which together with HIV-infection reduces the immunity of the females. In the second case, the high prevalence may be due to hormonal changes in the females at this age due to puberty and also their higher activity at this age due to house work and anxiety in planning for the future.

In terms of residential area of subjects, the Port Harcourt town area was found to have the highest tuberculosis prevalence for both HIV and non-HIV infected subjects. This

may be due to the fact that this area is densely populated so that tuberculosis can be easily transmitted. Also, this area of Port Harcourt is made up of large numbers of water-fronts and other settlements (slums) in which the very poor people in Port Harcourt dwell. As will be expected, the poor quality of life is a risk factor for the development of tuberculosis.

The high prevalence of tuberculosis in the Port Harcourt town area may also be attributed to the fact that there are lots of brothels of very low standard and the inhabitants of this area, especially females are involved in commercial sex due to poverty. This is a risk factor for HIV/AIDS and thus for tuberculosis.

The study also discovered a close relationship between the developments of tuberculosis in HIV sero-positive persons, compared to the development of tuberculosis in HIV sero-negative persons. This is due to the fact that HIV causes immunosuppression which opens the way for opportunistic infections of which tuberculosis is a chief culprit, especially in sub-Saharan Africa. [6]

Prevalence of tuberculosis (TB) is higher among HIV sero-positive persons than among HIV sero-negative persons. The ages between 15 and 50 years are most affected, of which males are more in number. Also, areas such as the Port Harcourt town area that is highly populated and harbours the poor people of the society, show higher prevalence rates compared to other parts of Port Harcourt due to poverty, and the crowded nature of the area. Infection with human immunodeficiency virus (HIV) has been reported as an important risk factor for tuberculosis. [12-14] Tuberculosis continues to occur and is the most common AIDS-associated opportunistic infection. [15] In recent times, a lot of people who suffer from tuberculosis are also HIV sero-positive, it is therefore necessary that patients diagnosed to be HIV sero-positive should also be tested for *Mycobacterium tuberculosis* infection and be given preventive chemotherapy to prevent the development of active tuberculosis (TB). The youths and young adults should be educated adequately on how to prevent the HIV and tuberculosis infections. The urban areas of Port Harcourt should be decongested of the activities that attract people to the cities. More jobs should be provided for the youths in the rural areas as this will prevent rural – urban migration. This would reduce the transmission of tuberculosis due to congestion of people and would also improve the quality of life of the inhabitants of Port Harcourt metropolis and of the inhabitants of the rural areas.

CONCLUSION:

In this study, the prevalence of tuberculosis and of HIV/TB co-infection rate was higher in males than in females in both the HIV sero-positive and HIV sero-negative subjects. The prevalence of tuberculosis (TB) was higher among HIV sero-positive persons than

among HIV sero-negative persons. This trend was found to be highest in the age group of 22 to 40 years. This increased prevalence is due to the fact that persons of this age group are more sexually active, usually with more than one partner, and indulge in the consumption of alcohol and smoking. These habits lead to reduced immunity causing these persons to develop tuberculosis more easily. The higher prevalence of tuberculosis recorded in the males is due to the fact that males are more involved these habits in the Port Harcourt Metropolis.

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