CHEST RADIOGRAPHIC PATTERNS AMONG HIV POSITIVE AND HIV NEGATIVE ADULTS WITH PULMONARY TUBERCULOSIS AT MWANANYAMALA HOSPITAL TB CLINIC

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CHEST RADIOGRAPHIC PATTERNS AMONG HIV POSITIVE AND HIV NEGATIVE ADULTS WITH PULMONARY TUBERCULOSIS AT MWANANYAMALA HOSPITAL TB CLINIC.

By

Balowa Musa Baraka

A dissertation Submitted in (partial) Fulfilment of the Requirements for the Degree of Master of Medicine (Radiology) of

Muhimbili University of Health and Allied Sciences

Muhimbili University of Health and Allied Sciences

September 2012

CERTIFICATION

The undersigned certify that he has read and hereby recommend for examination of dissertation entitled ***Chest radiographic patterns among HIV positive and HIV negative adults with pulmonary tuberculosis at Mwananyamala Hospital TB clinic,*** in fulfilment of the requirements for the degree of Master of Medicine (Radiology) of Muhimbili University of Health and Allied Sciences.

_____

Dr. R. R. Kazema

(Supervisor)

Date: _____

CERTIFICATION

The undersigned certify that he has read and hereby recommend for acceptance by Muhimbili University of Health and Allied Sciences a dissertation entitled ***Chest radiographic patterns among HIV positive and HIV negative adults with pulmonary tuberculosis at Mwananyamala Hospital TB clinic,*** in (Partial) fulfilment of the requirements for the degree of Master of Medicine (Radiology) of Muhimbili University of Health and Allied Sciences.

_____

Dr. R. R. Kazema

(Supervisor)

Date: _____

DECLARATION

AND

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I, **Balowa Musa Baraka**, declare that this **dissertation** entitled ***''Chest radiographic patterns among HIV positive and HIV negative adults with pulmonary tuberculosis at Mwananyamala Hospital TB clinic''*** is my own original work and that it has not been presented and will not be presented to any other university for a similar or any other degree award.

Signature……. Date……..

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DEDICATION

This dissertation is dedicated to

My father Mr. Musa Baraka Balowa for his everlasting encouragement and support

My treasured mother Zamwata Mrisho for her wonderful care and concern,

My beloved wife Fatma Perengo for her wonderful tender loving care and support

And our lovely wonderful daughter Zamwata Balowa.

ABSTRACT

Background: Tuberculosis is important global health problem. About one-third of the world's population and 30% of HIV positive patients are infected with *Mycobacterium tuberculosis.* TB patients infected with HIV have radiographic patterns of both primary and post primary pulmonary tuberculosis.

Objectives: This study aimed to determine differences in chest radiographic patterns among HIV positive and HIV negative adults.

Methodology: Patients newly diagnosed with smear positive PTB were randomly selected, HIV tested and chest radiographic patterns were extracted from re-evaluation of original chest radiographs and their radiologic reports.

Results: A total of 170 patients were included among them 100 were males and 70 were females. Fifty four patients (31.8%) were HIV/PTB co-infected. Females were significantly more HIV/PTB co-infected than males (51.4% vs 18.0%, p-value= 0.000). HIV/PTB co-infected patients compared to PTB only patients had significantly lesser cavities (44.4% vs 61.2%, p = 0.040), lesser alveolar consolidation (64.9% vs 81.7%, p = 0.04), HIV/PTB co-infected patients had more left and bilateral lung nodules 85.2% vs 60.9% (p = 0.023) and 70.4% vs 37.5% (p = 0.004) respectively, more miliary nodules (44.4% vs 15.6%, p = 0.003), more left upper, mid and lower zone nodules 59.3% vs 34.4% (p = 0.028), 77.8% vs 54.7% (p-value = 0.039) and 66.7% vs 34.4% (p = 0.005) respectively. HIV/PTB co-infected patients with CD4 $\geq$ 200µmol/l had more right mid zone consolidation (40,0% vs 4,5%, p = 0.007). No chest radiographic pattern which was highly associated with severe immunosuppression.

Conclusion: Prevalence of HIV among PTB patients is still high (31.8%). Most patients with smear positive pulmonary tuberculosis have abnormal chest radiographs. Pulmonary

cavities and alveolar consolidation are highly associated with negative HIV status. HIV positive patient with smear positive PTB were more likely to have left or bilateral pulmonary nodules, milliary nodules and left upper, mid and lower zone nodules. Right mid zone consolidation in HIV patients was associated with CD4 counts $\geq$ 200µmol/l. No radiographic pattern was highly associated with severe immunosuppression.

Recommendations: It is recommended that all HIV positive patients with pulmonary radiographic lesions to have sputum smear screening. Patients with pulmonary nodules should be evaluated for pulmonary tuberculosis and HIV. There is a need of more studies focusing on radiographic patterns among HIV positive and HIV negative patients using large community based sample.

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LIST OF ABREVIATIONS

AIDS	Acquired Immunodeficiency Syndrome
AMO	Assistant Medical Officers
ART	Anti Retroviral Treatment
CD4+	T-lymphocyte bearing CD4+ receptor
CI	Confidence interval
CO	Clinical Officer
CXR	Chest X-ray
HIV	Human Immunodeficiency Virus
HR	Hazards Regression
MD	Medical doctor
MUHAS	Muhimbili University of Health and Allied Sciences
NACP	National Aids Control Program
PLHIV	People Living With HIV
PTB	Pulmonary tuberculosis
PTB/HIV	Pulmonary tuberculosis patient with HIV co-infection.
RR	Relative risk
TB	Tuberculosis
WBC	White Blood Cells
WHO	World Health Organization

CHAPTER ONE

INTRODUCTION AND LITERATURE REVIEW

Introduction

Tuberculosis is important global health problem (1), it is the leading cause of morbidity and mortality among infectious diseases worldwide (1, 2). Among PTB patients some characteristics were independently associated with mortality. These factors included: older age at tuberculosis diagnosis ($p = 0.001$) (3); initial sputum smear positive for acid fast bacilli ($p = 0.004$) (3); TB/HIV co-infection ($p < 0.05$) (3, 4); low CD4 counts (4), and an interruption in tuberculosis therapy ($p = 0.002$) (3, 4). About one-third of the world's population is infected with *Mycobacterium tuberculosis* (2, 5), Approximately 1 in 10 people with primary PTB present clinically; of untreated cases, approximately 1 in 10 reactivate usually at a time of relative immunodeficiency (6). HIV significantly increases risk of latent TB reactivation, progression to active TB disease and associated immunosuppression makes it more difficult to diagnose active TB (7).

Chest radiographic patterns of PTB.

Chest radiographic patterns seen among patients are divided into typical and atypical tuberculosis. Typical adult tuberculosis is also known as post primary tuberculosis and has chest radiographs presenting with infiltration of the upper lung zone, with or without cavitation (8, 9). In another study done in Nigeria by Marchie et al; typical radiographic features of post primary tuberculosis were defined as consolidation, fibrosis, cavitations and apical locations (10). Atypical adult tuberculosis is also known as primary tuberculosis and has chest radiographs presenting with either normal chest radiograph, intrathoracic lymphadenopathy with or without parenchymal disease, localized non-cavitary disease in the lower lung zone, mid lung zone, or both if contiguous; or pleural effusion (8, 9, 11-16).

In addition to pleural effusion and normal chest radiograph; definition of atypical radiographic pattern included broncho-pulmonary or milliary infiltrates, hilar lymphadenopathy in Nigerian study (10); and diffuse and lower lobar opacities, mediastinal adenopathy and interstitial nodules in other studies (17, 18).

Disseminated pulmonary tuberculosis present with diffuse pulmonary nodules or milliary pattern has been observed in previous studies (18-20).

Chest radiographic patterns and HIV-status and immune-status.

Occurrence of chest radiographic patterns is affected by HIV status and degree of immune suppression (8, 13, 21). HIV/PTB co-infected patients when compared to HIV negative PTB patients have increased frequency of atypical pulmonary tuberculosis (8, 9, 19, 22-26). HIV positive patients when compared to HIV negative patients with PTB have less apical involvement in a study by Lawn et al (64.0% versus 85.5%; $p<0.001$) (27) and by Marchie et al (29.5% versus 79%; $p<0.001$) (10). Again a study done in Tanzania by Noronha et al found pulmonary lesions localized in mid or lower zones were more significantly found in HIV positive compared to HIV negative patients with PTB (20% versus 3.3%; $p=0.01$)(22). However in a study done by Salami et al it was found that PTB and EPTB are common amongst the HIV infected patients with mixed presentation being three times higher amongst the HIV positive than HIV negative patients (in 27 patients vs. 11 patients, p-value = 0.008) (20)

HIV/PTB co-infected patients with immunosuppression compared to HIV/PTB co-infected only (without immunosuppression) are significantly associated with atypical radiographic patterns (15, 28, 29). Also in another study done by Keiper et al, the mean CD4 counts was significantly lower in patients with atypical than typical radiographic pattern of post-primary pulmonary tuberculosis (69µmol/l versus 323 µmol/l, $p < 0.01$)(17). In a China

study by LU et al, AIDS patients had fewer upper lung or apical lesions (23.1% versus 76.7%, $p < 0.01$) (30).

Normal chest radiograph:

Normal chest radiographs in patients with PTB were seen in different studies ranging from 2.6% (8), 3.6% (31), 11% (18) to 11.5% (12, 32). They were more seen in HIV positive patients, however there was no statistical significance difference found between HIV positive and HIV negative patients with PTB (12, 17, 25, 31, 33). In AIDS (i.e. CD4 <200 cells/mm^3), frequency of normal chest radiograph was not significantly higher than in non-AIDS patients (i.e. CD4 > 200 cells/mm^3) (12, 17, 21, 31, 34-36).

Consolidation and nodules.

Parenchymal consolidation may involve any pulmonary lobe or segment in Primary TB (16, 32, 35), except for Ghon foci and Ranke complexes are right sided in distribution (32, 35). However they are situated in the apical and posterior segments of the upper lobes and the superior segment of the lower lobes, often associated with cavities in post primary TB (32). They appear with varying sizes from an area of homogenous opacification, infiltrates, nodules, macronodules to excavated nodules developing ultimately to cavities (14, 32, 35). Diffuse pulmonary infiltrate with or without intrathoracic lymph node enlargement is due to hematogenous TB spread (19).

According to HIV status; HIV positive patients compared to HIV negative patients were significantly less likely to have chest radiographs with consolidation pattern in several studies (8, 10, 27, 37). Similarly less broncho-pulmonary spread was found among HIV positive patients with PTB compared to HIV negative patients (27% versus 58.5%; $p<0.001$) (27). In a study done by de Albuquerque et al found non significantly absence of pulmonary nodules in HIV positive however they were found in HIV negative (0% versus

2.9%, p=0.598)(31). Again in the same study there were lesser frequency of focal infiltrates and diffuse infiltrates in HIV positive than HIV negative patients (61.5% versus 69.9%, p=0.390) and (5.1% versus 10.2%, p=0.390) respectively (31).

Also a study done in Kigali by Batungwanayo et al found significantly less upper lobe infiltrates (16% versus 55%; p < 0.02) (38); and less interstitial consolidation pattern in PTB patients co-infected with HIV than those with PTB only (40% versus 78%; p=0.012) (39).

In contrary HIV positive patients compared to HIV negative patients had chest radiographs with significantly more pneumonic infiltrates (46% versus 26%, p < 0.05) (40); broncho-pulmonary spread of PTB (73.5% versus 49%; p<0.001) (10); interstitial pattern (12% versus 7%; p = 0.01) and consolidation (10% versus 3%; p = 0.001) (11); alveolar consolidation (53.8% versus 8.3%; P < 0.01) (30). Similarly pulmonary nodules were more commonly found in HIV positive than HIV negative PTB patients (20% versus 13%, p=0.418) (39)..

According to the level of immunosuppression; AIDS patients complicated by pulmonary tuberculosis had significantly lesser consolidation pattern in several studies (30) (11.5% versus 71.7%; P < 0.01) and fewer upper lung or apical lesions (23.1% versus 76.7%; p < 0.01) in AIDS than non-AIDS patients complicated with PTB (8, 30). Also a study done by Perlman et al found lesser alveolar (52% versus 67%, p = 0.21) and more interstitial consolidation (27% versus 17%, p = 0.34) in patients with CD4 below 200µmol/l (33)

One study done by Garcia et al found distribution of pulmonary infiltrates was not significantly higher in the upper and mid lung zones in patients with CD4 < 200µmol/l than in patients with CD4 > 200µmol/l (29.6% versus 18.2%; p=0.23) (41).

Miliary spread was most commonly higher among HIV positive than HIV negative patients with pulmonary tuberculosis in several studies (11, 18-20, 26, 42, 43). Milliary pattern was found significantly more in HIV positive patients with PTB in several studies (11, 20, 26, 42, 43). Also the chance of miliary tuberculosis was four and half times higher in the HIV positive group (9 vs. 2: p-value = 0.03).

In contrary despite higher prevalence of miliary nodules there was no significant association with HIV positive status in several studies (25, 27, 31, 40).

Miliary spread and mixed presentation are signs of severe immunosuppression occurring at the lowest CD4+ cells count; 88 cells/µl and 93.6.6 cells/µl respectively (20).

Miliary spread was most commonly higher among HIV positive with AIDS than in patients without AIDS with pulmonary tuberculosis in several studies (17, 30, 41). Milliary pattern was found more in AIDS than in non AIDS patients in Pennsylvania (4/21 versus 0/1) (17), in Brazil (37% versus 9.1%, no p-value) (41), in China (23.1% versus 5%, $p<0.05$) (30).

Cavities

TB cavities are round of variable sizes having thick and irregular walls. They are found generally in upper lobes or apical segments of inferior lobes. Most often without fluid levels and sometimes a draining bronchus is visible. Sometimes they are associated with nodular, alveolar lesions or other cavities. The association of cavities with infiltrates and nodules is highly suggestive of TB (14, 35, 44). Cavitation implies a high bacillary burden and high infectivity (16, 44). Cavities appear more commonly in immune-competent or mildly immunosuppressed hosts (28). Cavitation is associated with numerous complications including endobronchial spread, tuberculous empyema, hematogenous dissemination, pulmonary artery pseudoaneurysm, and so forth (14, 16).

In several studies occurrence of pulmonary cavitations was significantly lesser frequent in HIV positive than HIV negative patients with pulmonary tuberculosis (8, 10, 11, 19, 25, 27, 39, 40). Pulmonary cavities were significantly lesser frequent in HIV positive than HIV negative patients with PTB in Uganda (18% versus 57%, $p < 0.05$) (40); in Ethiopia ($p < 0.001$) (25); in Brazil (70.8% versus 91.5%, p=0.0001) (19); again in Brazil (10% versus 43%, p=0.016) (39); also in Brazil (82.1% versus 50.4%, p=0.0005) (31); in Nigeria (30.5% versus 72%, $p < 0.001$) (10); in Zaire (33% versus 78%, p=0.001) (11); in Haiti (40/56 versus 136/156, $p < 0.05$) (8); and in Ghana (59.3% versus 71.7%, p=0.07)(27).

Similarly pulmonary cavities were observed none significantly less frequently in HIV patients with AIDS than in HIV patients without AIDS (2/6 versus 38/50) (8). Also in study done by Perlman et al found that pulmonary cavities was lesser frequent in patients with AIDS (CD4 below 200µmol/l) compared to patients without AIDS (7% versus 20%, p=0.08) (33). However when a pooled analysis of a study done by Pelman et al with similar other four studies found strong association of pulmonary cavities with CD4 $\geq$ 200µmol/l ($p<0.001$ [0.16-0.44]) (33).

HIV positive patients with AIDS than in patients without AIDS complicated with pulmonary tuberculosis had significantly lower frequency of pulmonary cavities in several studies (12, 19, 28, 30, 41). Pulmonary cavities were significantly lesser frequent in HIV positive patients with AIDS than in patients without AIDS with PTB in Brazil (63.3% versus 88.2%, $p = 0.007$) (19); in China (7.7% versus 30.0%, $p < 0.05$) (30); and in Uganda (27.4% versus 72.6%, $p < 0.001$) (28). Likewise patients with pulmonary tuberculosis and HIV- positive had upper field cavities more frequently observed in

patients with CD4 counts >200µmol/l than CD4 counts <200µmol/l (54.5% versus 7.4%, p=0.001) (41).

However in contrary, a study done in Brazil found more cavitation in chest radiographs of HIV positive patients with CD4 below 200 µmol/l (57% versus 43%, p > 0.05) (12).

Lymphadenopathy.

Intrathoracic lymphadenopathy is the radiologic hallmark of primary TB; it is rare in post-primary TB (16, 35). Most commonly seen at right paratracheal and hilar regions, however various patterns may also occur such as bilateral hilar or isolated mediastinal lymphadenopathy (11-13, 18).

Intrathoracic lymphadenopathy has been observed more frequently in HIV positive than HIV negative patients with PTB in several studies (10, 12, 17, 19, 22, 26, 28, 31, 38-40, 42, 45, 46). Significant occurrence of intrathoracic lymphadenopathy in HIV positive patients has been documented in several studies (8, 10, 11, 19, 26, 27, 30, 40, 43, 45, 46). In Tunisia Intrathoracic lymphadenopathy was rare (36).

Intrathoracic lymphadenopathy has been more commonly in HIV patients with PTB and AIDS than in patients without AIDS. This was found in China by Lu et al (34.6% versus 8.3%; P < 0.01) (30). Also in a study done by Perlman et al (30%, vs. 7%; P = .01) (33), Batungwanayo et al (40% versus 7; p < 0.04) (38) and in Brazil by Picon et al (47 versus 266 µmol/l; p < 0.0001) (19). However in a study done by Long et al, intrathoracic lymphadenopathy was lower in AIDS patients than in non-AIDS patients (8). Similarly a study done in Rwanda by Batungwanayo et al found lesser mediastinal or hila lymphadenopathy in HIV positive patients meeting WHO clinical criteria for AIDS co-infected with PTB (7 versus 40%; p < 0.04) (38).

Pleural effusion

Pleural effusion is one of the features of atypical tuberculosis (8, 9, 11-16). It is more frequently seen in HIV- seropositive patients with tuberculosis (11, 27, 28, 38, 40). Also more frequent seen in patients with AIDS (21, 28, 30).

Pleural effusion was significantly of higher proportion in HIV positive patients with pulmonary tuberculosis in Zaire (16% vs 6.8%; P = 0.001)(11), in Ghana (17.4% versus 6.6%, $p < 0.05$) (27), in Nigeria (24% versus 8%, $p < 0.001$) (10), in Rwanda (43% versus 9%, $p < 0.05$) (38), in Ethiopia (22% versus 6.7%, $p < 0.01$) (47) and in South Africa (38% versus 20%, $p <0.05$) (43).

However pleural effusion was not-significantly of higher proportion in HIV positive patients with pulmonary tuberculosis in Brazil (15.4% versus 8.1, p=0.141) (31), similarly in Uganda (23% versus 11%, $p >0.05$) (40), again in Brazil (18.6% versus 14.4%, p=0.392) (19)

Contrary to above studies pleural effusion was not-significantly lower in HIV positive patients than HIV negative patients with pulmonary tuberculosis in Haiti (9% versus 12%, $p > 0.05$) (8), similarly in Brazil (20% versus 30.4%, p=0.335) (39).

Pleural effusion was lower in HIV positive patients with AIDS and pulmonary tuberculosis in United States (33), also in Brazil (47.6% CD4 counts < 200µmol/l) (12) and in a study done in Haiti (0% versus 11%, $p > 0.05$) (8). Contrary to above studies pleural effusion was not-significantly higher in HIV positive patients with AIDS than without AIDS in Brazil (20.3% versus 14.7%, p=0.487) (19), also in Brazil (22.2% versus 9.1%, p=0.69) (41).

Throughout literature review there are discrepancies in the occurrence of chest radiographic patterns among PTB patients with respect to HIV status and CD4 levels

among HIV positive patients. Also there is no prior study in Tanzania addressing the above mentioned theme.

PROBLEM STATEMENT

Tuberculosis (TB) still remains a significant global health problem and the leading cause of morbidity and mortality from infectious diseases(2). CXR is simple, low cost and gives large amount of information(48). With wide availability of X-ray facilities throughout the country, CXR is important in evaluation of suspected or proven PTB (16, 48, 49). Abnormal CXR features such as presence of cavities, upper lobe infiltrate and miliary pattern were associated with TB in different countries (50). Hence an abnormal CXR has been helpful in diagnosis and for presumptive treatment of TB (51). Also finding of cavities on CXR of TB patient has been associated with presence of active TB hence high infectivity of the host (44). HIV seropositive patients with pulmonary tuberculosis and immunosuppression have atypical clinical features (52) also atypical radiographic patterns (15, 28, 29). Hence they may suffer from delays for treatment due to misdiagnosis (52) or delays in diagnosis(53). Therefore they are likely to have increased morbidity or risk of death from an otherwise curable illness (52, 53). On review of literature there are discrepancies in the occurrence of chest radiographic patterns among PTB patients with respect to HIV status and CD4 levels among HIV positive patients. Also there is no prior study in Tanzania that was done addressing chest radiographic patterns and their association with HIV status and CD4 levels. Therefore finding of most common radiographic presentation of PTB among PLHIV in our setting will be crucial to the timely diagnosis, proper treatment and management of TB patients in Tanzania.

RATIONALE

Chest radiography is cheap, safe and widely available imaging modality in assessing pulmonary manifestations of HIV/AIDS, and together with clinical and level of immunosupression will help to differentiate between typical and atypical PTB presentation (48).

Chest X-ray facilities are widely available in all district hospitals all over Tanzania. In these facilities different health professionals such as MDs, AMOs and COs are involved in the investigation and management of TB suspects as well as TB patients. They all serve in TB screening sites but their knowledge and skill on interpretation of chest radiographic patterns and association with TB is varied hence this study will serve as the starting point on the demonstration of the chest radiographic findings in TB and their variation in HIV. Chest X-ray is used in the diagnosis, follow up and monitoring of patients with PTB especially in patients co-infected with HIV and in settings of smear negative PTB.

Therefore common chest radiographic patterns of PTB gathered in this study will help towards better understanding of radiographic presentation of TB.

Upon dissemination of research findings, knowledge gathered in this study will help towards harmonization of interpretation radiographic patterns among health professionals. This will be crucial to the timely diagnosis, proper treatment and management of TB patients in Tanzania.

CHAPTER TWO

OBJECTIVES

BROAD OBJECTIVE

To determine common chest radiographic patterns among HIV positive and HIV negative adults with PTB attending Mwananyamala Municipal hospital from July to December 2011.

SPECIFIC OBJECTIVES

1. To determine the distribution of adults with Tuberculosis attending Mwananyamala Municipal hospital by socio-demographic factors from July to December 2011.
2. To determine distribution of chest radiographic patterns among adults with Tuberculosis attending Mwananyamala Municipal hospital from July to December 2011.
3. To determine the association between chest radiographic patterns and HIV status among adults with Tuberculosis and HIV attending Mwananyamala Municipal hospital from July to December 2011
4. To determine the association between chest radiographic patterns and level of CD4 counts among adults with Tuberculosis and HIV attending Mwananyamala Municipal hospital from July to December 2011.

METHODOLOGY

Study design

This was a hospital based cross sectional study.

Period of the study

The study was conducted for six months duration, between July and December, 2011.

Study setting

The study was conducted at TB clinic of Mwananyamala Municipal hospital. This clinic is equipped with two consultation rooms for enrolment and treatment of PTB patients, one room dedicated for laboratory in which sputum smear AFB screening is done, one room for Voluntary Counselling and Testing for HIV serostatus and one room for research where by all patients with AFB smear positive and HIV seropositive are followed up with CD4 determination. Usually patients from different areas of Kinondoni and nearby districts come for TB and HIV screening and anti-TB treatment. Patients who are AFB smear positive and eligible for ARVs' are referred to TB/HIV Clinic for further management including ARV treatment.

Study population;

The study population consists of all newly diagnosed smear positive PTB patients presented during the study period.

Inclusion criteria:

All of the following conditions had to be fulfilled by patients that were included in the study:-

1. Adult patient aged eighteen years and above
2. Newly diagnosed smear positive PTB patients on sputum microscopy.

3. Patients who agreed to have HIV-serostatus and CD4 level determined if patient was HIV positive
4. Patients who agreed to undergo chest radiography, agreed to have brought their original chest radiographs to be re-evaluated by the researcher and their original radiologic reports to be compared by the researcher's radiographic reports.
5. Participants who gave written informed consent

Exclusion criteria

Any of the following conditions led to the exclusion of patients from the study:-

1. PTB patients with no positive sputum smear results.
2. Patients who did not agree to have their HIV-serostatus examined and their CD4 level determined if patient was HIV positive.
3. Patients who refused to undergo chest radiography or those who disagreed for their original chest radiographs to be re-evaluated by the researcher and their original radiologic reports to be compared by the researcher's radiographic reports.
4. Extremely sick patient who need immediate treatment.
5. PTB patients aged below 18 years old including children.

Sampling technique;

All eligible participants were recruited consecutively until the sample size was reached. Information regarding this study was provided to participants and informed consent was sought for prior to recruitment.

Sampling procedure

DTLCs and TBHIV co-ordinators of Mwananyamala I and Mwananyamala II TB treatment districts explained about the research to all patients who attended to the TB clinic before their enrolment into TB treatment. Agreed patients were then presented to the

researcher who gave explanation about importance of the research to participants. All participants who came with chest radiographs were requested to undergo sputum AFB screening for TB and also all smear positive patients with no chest radiographs were requested to undergo chest radiography. All consented participants with smear positive PTB and chest radiographs who met inclusion criteria were recruited into the study.

Sample size estimation;

Considering the study power of 95%, a random likely error is estimated to be 0.05. The sample size of 162 patients to be studied was estimated based on a study done by Bakari prevalence of TB was found to be 12% (51). The standard sample size estimation (**Kish & Leslie**) formula is:

$\mathbf{N = Z^2P\ (1\text{-}P) \div E^2}$ Where by:

Z- is the point of normal distribution corresponding to the significance level 1.96;

P-prevalence from the study done by Bakari et al is 12%; **E** -maximum likely error 0.05.

From this formula the sample size is calculated as follows:

$\mathbf{N = (1.96)^2\ X\ 0.12(1 - 0.12) \div (0.05)^2 \approx 162.269}$

Therefore the total sample size was 170 patients with sputum smear positive pulmonary tuberculosis.

Data Collection

Questionnaires

Structured questionnaires consist of socio-demographic factors such as age, sex, marital status and level of education, also clinical symptoms, radiographic findings and HIV serostatus and level of CD4 among HIV-positive patients.

Chest x-ray

A high KV technique chest radiograph postero-anterior (PA) view was obtained by a Radiographer using PHILIPS HD 30 system (Best, Eindhoven, The Netherlands).

All chest x-rays were reported by a qualified radiologist at Mwananyamala Hospital Radiology Department and original chest radiographs was re-evaluated by the researcher prior to HIV testing and CD4 count determination. Hence both radiologist and researcher were blinded for HIV status and or CD4 counts of patients. This minimized observer bias. Radiologic reports were compared and in case of differences discussions were done between the radiologist and the researcher and a consensus was reached. Chest radiographic patterns included consolidation, lung nodules, cavities, hila lymphadenopathy, mediastinal widening and pleural effusion. Only chest radiographs of smear positive patients who met inclusion criteria were involved in the study. Data was entered in the questionnaire.

Definition of terms (54, 55)

Cavity is a lucent area within the lung that may or may not contain a fluid level and that is surrounded by a wall, usually of varied thickness.

Consolidation is as a homogeneous increase in pulmonary parenchymal attenuation that obscures the margins of vessels and airway walls of the lung associated with little or no loss of lung volume. The term in this study is used for alveolar, interstitial and mixed infiltrates.

Milliary nodules are widespread, tiny, discrete uniform round opacities measuring $\leq$ 2mm.

Micro nodule is an oval or round pulmonary opacity measuring 2 to 5mm.

Macronodule is an oval or round opacity measuring 0.5 to 3cm.

Mass is an oval or round opacity measuring more than 3cm.

Data analysis

All questionnaires were daily filled and checked for completeness and accuracy by the investigator. Filled questionnaires were coded before entering into the computer using statistical packages for social science (SPSS). Data cleaning was done by consistence checks. Statistical analysis was performed using SPSS version 15. Frequency distribution and two way tables were used to summarize the data. Chi-square (X^2) and Fisher's exact tests were used to determine the association between independent and dependent categorical variables. P value of < 0.05 was considered statistically significant**.**

Ethical issues

1. Ethical clearance was sought from ethical clearance board (IRB) of the Muhimbili University of Health and Allied Sciences (MUHAS).
2. Permission to conduct the study was sought from District Medical Officer of Kinondoni municipality and Mwananyamala Hospital administration where I was allowed to conduct the study at TB Clinic of Mwananyamala Hospital.
3. An informed consent (verbal and written) was sought from the patients prior to conduction of interview and performing and re-evaluation of their chest radiograph and comparison of their radiologic reports.
4. Confidentiality was observed during talking to patient and performing and re-evaluation of their chest radiograph and comparison of their radiologic reports.

Patient's disposal

The investigator worked in close collaboration with all health care workers in day to day activities at TB clinic in facilitating continuum of care and follow up visits of the participants.

CHAPTER THREE

RESULTS

Table 1: Distribution of socio-demographic characteristics by HIV status among adults with AFB sputum smear positive Pulmonary Tuberculosis.

Socio-demographic characteristic	HIV STATUS		TOTAL	X^2	p-value
	POSITIVE	NEGATIVE			
Age group	**N=54**	**N=116**	**N=170**		
18 to 25 years	7 (20.0%)	28 (80.0%)	35 (100%)	3.948	0.139
26 to 35 years	17 (29.8%)	40 (70.2%)	57 (100%)		
More than 35 years	30 (38.5%)	48 (61.5%)	78 (100%)		
SEX	**N=54**	**N=116**	**N=170**		
Male	18 (18.0%)	82 (82.0%)	100 (100%)	21.229	0.000
Female	36 (51.4%)	34 (48.6%)	70 (100%)		
Total	54 (31.8%)	116 (68.2%)	170 (100%)		
Marital status	**N=54**	**N=116**	**N=170**		
Never married	18 (27.69%)	47 (72.31%)	65 (100%)	8.536	0.036
Married	21 (26.92%)	57 (73.08%)	78 (100%)		
Divorced	9 (52.94%)	8 (47.06%)	17 (100%)		
Widowed	6 (60%)	4 (40%)	10 (100%)		
Education level	**N=54**	**N=116**	**N=170**		
Never to school	4 (28.57%)	10 (71.43%)	14 (100%)	7.076	0.132
Primary	31 (29.52%)	74 (70.48%)	105 (100%)		
Secondary	15 (32.61%)	31(67.39%)	46 (100%)		
College	3 (100%)	0 (0%)	3 (100%)		
Higher education	1 (50%)	1 (50%)	2 (100%)		
Employment	**N=54**	**N=116**	**N=170**		
Self employed	27 (32.14%)	57 (67.86%)	84 (100%)	0.031	0.985
Formally employed	11 (30.56%)	25 (69.44%)	36 (100%)		
Un-employed	16 (32%)	34 (68%)	50 (100%)		

A total of 170 eligible patients consented and were involved in the study. The study sample had age ranging from 18 years to 80 years, with mean, median and modal age of 36.89, 35 and 30 years respectively.

Males were 100 (58.8%) and 70 (41.2%) were females. Prevalence of PTB/HIV coinfection in the study population was 31.8%. Females were significantly more PTB/HIV co-infected than males (51.4% vs 18.0%, p-value= 0.000).

Among the study population PTB/HIV co-infection was significantly higher among divorced (52.9%) and widowed (60.0%) compared to married (26.92%) and never married (27.69%) patients (p-value = 0.036).

Most patients were aged more than 35years. PTB/HIV co-infection was highest among patients aged more than 35years (38.5%) compared to other age groups (p-value = 0.139).

Most patients had primary education (i.e. 105/170). PTB/HIV co-infection was high among patients with college (100%) or university (50%) (p-value = 0.132).

Most patients were self-employed in overall 84/170. PTB/HIV co-infection was slightly similarly higher in self-employed (32.61%) followed by un-employed (32%) and the least was in formally employed patients (30.56%) (p=0.985).

Table 2.1: Distribution of pulmonary consolidation by HIV status among patients with AFB sputum smear positive Pulmonary Tuberculosis.

CONSOLIDATION	HIV STATUS		TOTAL	X^2	P-value
	POSITIVE	NEGATIVE			
Presence	**N=54**	**N=116**	**N=170**		
Yes	37 (68.5%)	93 (80.2%)	130 (76.5%)	2.781	0.095
No	17 (31.5%)	23 (19.8%)	40 (23.5%)		
Pattern					
Interstitial	**N=37**	**N=93**	**N=130**		
Yes	20 (54.1%)	37 (39.8%)	57 (43.8%)	2.189	0.139
No	17 (45.9%)	56 (60.2%)	73 (56.2%)		
Alveolar	**N=37**	**N=93**	**N=130**		
Yes	24 (64.9%)	76 (81.7%)	100 (76.9%)	4.236	0.04
No	13 (35.1%)	17 (18.3%)	30 (23.1%)		
Mixed	**N=37**	**N=93**	**N=130**		
Yes	7 (18.9%)	20 (21.5%)	27 (20.8%)	0.108	0.743
No	30 (81.1%)	73 (78.5%)	103 (79.2%)		
Lung involvement					
Right	**N=37**	**N=93**	**N=130**		
Yes	21 (56.8%)	58 (62.4%)	79 (60.8%)	0.349	0.555
No	16 (43.2%)	35 (37.6%)	51 (39.2%)		
Left	**N=37**	**N=93**	**N=130**		
Yes	28 (75.7%)	64 (68.8%)	92 (70.8%)	0.602	0.438
No	9 (24.3%)	29 (31.2%)	38 (29.2%)		
Bilateral	**N=37**	**N=93**	**N=130**		
Yes	12 (32.4%)	29 (31.2%)	41 (31, 5%)	0.019	0.890
No	25 (67.6%)	64 (68.8%)	89 (68.5%)		

HIV/PTB co-infected patients compared to PTB only had CXRs with significantly lesser alveolar consolidation pattern (64.9% vs 81.7%, p-value = 0.04), higher interstitial consolidation pattern (54,1% vs 39.8%, p-value = 0.139), and lesser mixed consolidation pattern (18.9% vs 21.5%, p-value = 0.743)

HIV/PTB co-infected patients compared to PTB only had CXRs with lesser right lung consolidation (56.8% vs 62.4%, p-value = 0.555); higher left lung consolidation (75.7% vs 68.8%, p-value = 0.438) and slightly higher bilateral consolidation (32.4% vs 31.2%, p-value = 0.890)

Table 2.2: Zonal distribution of pulmonary consolidation by HIV status among patients with AFB sputum smear positive Pulmonary Tuberculosis.

	HIV STATUS				
CONSOLIDATION	**POSITIVE**	**NEGATIVE**	**TOTAL**	X^2	**P-value**
Zonal distribution					
Right Upper Zone	**N=37**	**N=93**	**N=130**		
Yes	13 (35.1%)	43 (46.2%)	56 (43.1%)	1.330	0.249
No	24 (64.9%)	50 (53.8%)	74 (56.9%)		
Right Mid Zone	**N=37**	**N=93**	**N=130**		
Yes	7 (18.9%)	24 (25.8%)	31 (23.8%)	0.691	0.406
No	30 (81.1%)	69 (74.2%)	99 (76.2%)		
Right Lower Zone	**N=37**	**N=93**	**N=130**		
Yes	7 (18.9%)	18 (19.4%)	25 (19.2%)	0.003	0.955
No	30 (81.1%)	75 (80.6%)	105 (80.8%)		
Left Upper Zone	**N=37**	**N=93**	**N=130**		
Yes	16 (43.2%)	40 (43.0%)	56 (43.1%)	0.001	0.981
No	21 (56.8%)	53 (57.0%)	74 (56.9%)		
Left Mid Zone	**N=37**	**N=93**	**N=130**		
Yes	11 (29.7%)	36 (38.7%)	47 (36.2%)	0.925	0.336
No	26 (70.3%)	57 (61.3%)	83 (63.8%)		
Left Lower Zone	**N=37**	**N=93**	**N=130**		
Yes	16 (43.2%)	31 (33.3%)	47 (36.2%)	1.126	0.286
No	21 (56.8%)	62 (66.7%)	83 (63.8%)		

HIV/PTB co-infected patients compared to PTB only had CXRs with lesser right upper zone consolidation (35.1% vs 46.2%, p-value = 0.249), lesser right mid zone consolidation

(18.9% vs 25.8%, p-value = 0.406) and lesser right lower zone consolidation (18.9% vs 19.4%, p-value = 0.955).

HIV/PTB co-infected patients compared to PTB only had CXRs with slightly higher left upper zone consolidation (43.2% vs 43.0%, p-value = 0.981), lesser left mid zone consolidation (29.7% vs 38.7%, p-value = 0.336) and higher left lower zone consolidation (43.2% vs 33.3%, p-value = 0.286).

Table 3.1: Distribution of pulmonary nodules by HIV status among patients with AFB sputum smear positive Pulmonary Tuberculosis.

	HIVSTATUS				
NODULES	**POSITIVE**	**NEGATIVE**	**TOTAL**	X^2	**P-value**
Presence	**N=54**	**N=116**	**N=170**		
Yes	27 (50.0%)	64 (55.2%)	91 (53.5%)	0.396	0.529
No	27 (50.0%)	52 (44.8%)	79 (46.5%)		
Type	**N=27**	**N=64**	**N=91**		
Micronodules	24 (88.9%)	49 (76.6%)	73 (80.2%)	1.818	0.178
Macronodules	3 (11.1%)	15 (23.4%)	18 (19.8%)		
Lung involvement					
Right Lung	**N=27**	**N=64**	**N=91**		
Yes	23 (85.2%)	49 (76.6%)	72 (79.1%)	0.855	0.355
No	4 (14.8%)	15 (23.4%)	19 (20.9%)		
Left Lung	**N=27**	**N=64**	**N=91**		
Yes	23 (85.2%)	39 (60.9%)	62 (68.1%)	5.142	0.023
No	4 (14.8%)	25 (39.1%)	29 (31.9%)		
Bilateral	**N=27**	**N=64**	**N=91**		
Yes	19 (70.4%)	24 (37.5%)	43 (47.3%)	8.232	0.004
No	8 (29.6%)	40 (62.5%)	48 (52.7%)		

Patients with AFB sputum smear positive Pulmonary Tuberculosis had CXRs with highest prevalence of micronodules 73/91 (80.2%) and right lung involvement 72 (79.1%) while bilateral lung involvement of nodules was least prevalent pattern 43 (47.3%).

HIV/PTB co-infected patients compared to PTB only had CXRs with lesser lung nodules (50.0% vs 55.2%, p-0.529), higher micronodules (88.6% vs 76.6%) and lesser macronodules (11.1% versus 19.8%) (p=value 0.178).

HIV/PTB co-infected patients compared to PTB only had CXRs with significantly higher right lung nodules (85.2% vs 76.6%, p-value = 0.355); significantly higher left lung

nodules (85.2% vs 60.9%, p-value = 0.023) and bilateral lung nodules (70.4% vs 37.5%, p-value = 0.004).

Table 3.2: Zonal distribution of pulmonary nodules by HIV status among patients with AFB sputum smear positive Pulmonary Tuberculosis.

	HIVSTATUS				
NODULES	**POSITIVE**	**NEGATIVE**	**TOTAL**	X^2	**p-value**
Zonal distribution					
Right Upper Zone	**N=27**	**N=64**	**N=91**		
Yes	15 (55,6%)	24 (37,5%)	39 (42,9%)	2.528	0.112
No	12 (44,4%)	40 (62,5%)	52 (57,1%)		
Right Mid Zone	**N=27**	**N=64**	**N=91**		
Yes	20 (74,1%)	36 (56,3%)	56 (61,5%)	2.549	0.110
No	7 (25,9%)	28 (43,8%)	35 (38,5%)		
Right Lower Zone	**N=27**	**N=64**	**N=91**		
Yes	15 (55,6%)	26 (40,6%)	41 (45,1%)	1.710	0.191
No	12 (44,4%)	38 (59,4%)	50 (54,9%)		
Left Upper Zone	**N=27**	**N=64**	**N=91**		
Yes	16 (59,3%)	22 (34,4%)	38 (41,8%)	4.835	0.028
No	11 (40,7%)	42 (65,6%)	53 (58,2%)		
Left Mid Zone	**N=27**	**N=64**	**N=91**		
Yes	21 (77,8%)	35 (54,7%)	56 (61,5%)	4.277	0.039
No	6 (22,2%)	29 (45,3%)	35 (38,5%)		
Left Lower Zone	**N=27**	**N=64**	**N=91**		
Yes	18 (66,7%)	22 (34,4%)	40 (44,0%)	8.038	0.005
No	9 (33,3%)	42 (65,6%)	51 (56,0%)		
Milliary nodules	**N=27**	**N=64**	**N=91**		
Yes	12 (44,4%)	10 (15,6%)	22 (24,2%)	8.604	0.003
No	15 (55,6%)	54 (84,4%)	69 (75,8%)		

Among chest radiographs of patients with PTB nodules were mostly and equally present in right and left mid lung zones.

HIV/PTB co-infected patients compared to PTB only had CXRs with higher right upper zone nodules (55.6% vs 37.2%, p-value = 0.112), higher right mid zone nodules (74.1% vs 56.3%, p-value = 0.110) and higher right lower zone nodules (55.6% vs 40.6%, p-value = 0.191).

HIV/PTB co-infected patients compared to PTB only had CXRs with significantly higher left upper zone nodules (59.3% vs 34.4%, p-value = 0.028), left mid zone nodules (77.8% vs 54.7%, p-value = 0.039) and left lower zone nodules (66.7% vs 34.4%, p-value = 0.005) and milliary nodules (44.4% vs 15.6%, p-value = 0.003).

Table 4.1: Distribution of pulmonary cavities by HIV status among patients with AFB sputum smear positive Pulmonary Tuberculosis.

	HIV STATUS				
CAVITIES	**POSITIVE**	**NEGATIVE**	**TOTAL**	X^2	**P-value**
Presence	**N=54**	**N=116**	**N=170**		
Yes	24 (44,4%)	71 (61,2%)	95 (55,9%)	4.199	0.040
No	30 (55,6%)	45 (38,8%)	75 (44,1%)		
Cavity wall	**N=24**	**N=71**	**N=95**		
Thin walled	6 (25,0%)	21 (29,6%)	27 (28,4%)	0.185	0.667
Thick walled	18 (75,0%)	50 (70,4%)	68 (71,6%)		
Lung involvement					
Right lung	**N=24**	**N=71**	**N=95**		
Yes	13 (54,2%)	45 (63,4%)	58 (61,1%)	0.640	0.424
No	11 (45,8%)	26 (36,6%)	37 (38,9%)		
Left lung	**N=24**	**N=71**	**N=95**		
Yes	16 (66,7%)	40 (56,3%)	56 (58,9%)	0.791	0.374
No	8 (33,3%)	31 (43,7%)	39 (41,1%)		
Bilateral	**N=24**	**N=71**	**N=95**		
Yes	5 (20,8%)	16 (22,5%)	21 (22,1%)	0.030	0.862
No	19 (79,2%)	55 (77,5%)	74 (77,9%)		

Among chest radiographs of patients with PTB, cavities were found in 95 (55.9%).

Thick walled cavities were most prevalent 68 (71.6%).

Right lung involvement was the most prevalent pattern 58 (61.1%),

Bilateral lung involvement of nodules was least prevalent pattern21 (22.1%).

HIV/PTB co-infected patients compared to PTB only had CXRs with lesser cavities (44.4% vs 61.2%, p-value = 0.040) and higher thick walled cavities (75.0% vs 70.4%) and lesser thin walled cavities (25.0% versus 29.6%) (p-value = 0.667).

HIV/PTB co-infected patients compared to PTB only had CXRs with lesser right lung cavities (54.2% vs 63.4%, p-value = 0.424), higher left lung cavities (66.7% vs 56.3%, p-value = 0.374) and lesser bilateral lung cavities (20.8% vs 22.5%, p-value = 0.862).

Table 4.2: Lung zonal distribution of pulmonary cavities by HIV status among patients with AFB sputum smear positive Pulmonary Tuberculosis.

	HIV STATUS				
CAVITIES	**POSITIVE**	**NEGATIVE**	**TOTAL**	X^2	**P-value**
Zonal distribution					
Right Upper Zone	**N=24**	**N=71**	**N=95**		
Yes	8 (33,3%)	40 (56,3%)	48 (50,5%)	3.797	0.051
No	16 (66,7%)	31 (43,7%)	47 (49,5%)		
Right Mid Zone	**N=24**	**N=71**	**N=95**		
Yes	4 (16,7%)	6 (8,5%)	10 (10,5%)	1.286	0.257
No	20 (83,3%)	65 (91,5%)	85 (89,5%)		
Right Lowe Zone	**N=24**	**N=71**	**N=95**		
Yes	2 (8,3%)	4 (5,6%)	6 (6,3%)	0.221	0.638
No	22 (91,7%)	67 (94,4%)	89 (93,7%)		
Left Upper Zone	**N=24**	**N=71**	**N=95**		
Yes	10 (41,7%)	28 (39,4%)	38 (40,0%)	0.037	0.847
No	14 (58,3%)	43 (60,6%)	57 (60,0%)		
Left Mid Zone	**N=24**	**N=71**	**N=95**		
Yes	8 (33,3%)	12 (16,9%)	20 (21,1%)	2.914	0.088
No	16 (66,7%)	59 (83,1%)	75 (78,9%)		
Left Lower Zone	**N=24**	**N=71**	**N=95**		
Yes	3 (12,5%)	3 (4,2%)	6 (6,3%)	2.076	0.150
No	21 (87,5%)	68 (95,8%)	89 (93,7%)		

Right upper zone cavities were most prevalent (50.5%) followed by left upper zone cavities (40.0%) and lower zone cavities were least prevalent (6.3%)

HIV/PTB co-infected patients compared to PTB only had CXRs with lesser right upper zone cavities (33.3% vs 56.3%, p-value = 0.051), higher right mid zone walled cavities (16.7% vs 8.5%, p-value = 0.257) and higher right lower zone cavities (8.3% vs 5.6%, p-value = 0.638)

HIV/PTB co-infected patients compared to PTB only had CXRs with higher left upper zone cavities (41.7% vs 39.4%, p-value = 0.847), higher left mid zone cavities (33.3% vs 16.9%, p-value = 0.088) and higher left lower zone cavities (12.5% vs 4.2%, p-value = 0.150).

Table 5.1: Distribution of intrathoracic lymphadenopathy by HIV status among patients with AFB sputum smear positive Pulmonary Tuberculosis.

Intrathoracic lymphadenopathy	**HIV STATUS**		**TOTAL**	X^2	**p-value**
	POSITIVE	**NEGATIVE**			
Presence	**N = 54**	**N = 116**	**N = 170**		
Yes	32 (59.3%)	65 (56.0%)	97 (57.1%)	0.156	0.693
No	22 (40.7%)	51 (44.0%)	73 (42.9%)		
Hila lymphadenopathy					
Presence	**N=54**	**N=116**	**N=170**		
Yes	32 (59,3%)	60 (51,7%)	92 (54,1%)	0.843	0.359
No	22 (40,7%)	56 (48,3%)	78 (45,9%)		
Distribution	**N=32**	**N=60**	**N=92**		
Unilateral	18 (56,3%)	37 (61,7%)	55 (59,8%)	0.255	0.614
Bilateral	14 (43,8%)	23 (38,3%)	37 (40,2%)		
Mediastinal lymphadenopathy					
Presence	**N=54**	**N=116**	**N=170**		
Yes	9 (16,7%)	29 (25%)	38 (22,4%)	1.474	0.225
No	45 (83,3%)	87 (75%)	132 (77,6%)		
Distribution	**N=9**	**N=29**	**N=38**		
Unilateral	4 (44,4%)	15 (51,7%)	19 (50%)	0.146	0.703
Bilateral	5 (55,6%)	14 (48,3%)	19 (50%)		

Among chest radiographs of patients with PTB, intrathoracic, mediastinal and hilar lymphadenopathy was found in 97 (57.1%), 38 (22.4%) and 92 (54.1%) respectively.

HIV/PTB co-infected patients compared to PTB only had CXRs with higher prevalence of intrathoracic lymphadenopathy (59.3% versus 56.0%, p-value = 0.693)

HIV/PTB co-infected patients compared to PTB only had CXRs with higher prevalence of hila lymphadenopathy (59.3% versus 51.7%, p-value = 0.359) and higher bilateral hila lymphadenopathy (43.8% versus 38.3%) and lesser unilateral hila lymphadenopathy (56.3% versus 61.7%), p-value = 0.614.

HIV/PTB co-infected patients compared to PTB only had CXRs with lower prevalence of mediastinal lymphadenopathy (16.7% vs 25%, p-value = 0.225) and higher bilateral mediastinal widening (55.6% vs 48.3%) and lesser unilateral mediastinal widening (44.4% vs 51.7%), p-value = 0.703.

Table 6. Distribution of pleural effusion by HIV status among patients with AFB sputum smear positive Pulmonary Tuberculosis.

	HIV STATUS				
PLEURAL EFFUSION	**POSITIVE**	**NEGATIVE**	**TOTAL**	X^2	**p-value**
Presence	**N=54**	**N=116**	**N=170**		
Yes	15 (27,8%)	38 (32,8%)	53 (31,2%)	0.426	0.514
No	39 (72,2%)	78 (67,2%)	117 (68,8%)		
Distribution	**N=15**	**N=38**	**N=53**		
Unilateral	13 (86,7%)	32 (84,2%)	45 (84,9%)	0.051	0.822
Bilateral	2 (13,3%)	6 (15,8%)	8 (15,1%)		

Among chest radiographs of patients with PTB, pleural effusion was found in 53 (31.2%). HIV/PTB co-infected patients compared to PTB only had CXRs with lower prevalence of pleural effusion (27.8% vs 32.8%, p-value = 0.514) also lesser bilateral pleural effusion (13.3% vs 15.8%), (p-value = 0.822) and higher unilateral pleural effusion (86.7% vs 84.2%).

Table 7.1: Frequency distribution of CD4 levels among PTB/HIV co-infected patients

CD4 level (µmol/l)	Frequency	Percentage (%)	Cumulative Percent
≥ 200	21	38.9	38.9
< 200	33	61.1	100.0
Total	54	100.0	

Most of PTB/HIV co-infected patients had CD4 counts less than 200µmol/l.

Table 7.2: Descriptive statistics of CD4 counts among PTB/HIV co-infected patients

	Minimum	Maximum	Mean	Standard Deviation
CD4 counts (µmol/l)	14	864	225.70	204.257

Among 54 HIV/PTB co-infected patients; there was minimum, maximum, mean and standard deviation of 14, 864, 225.7 and 204.257 of CD4 counts (in µmol/l) respectively.

Table 8.1: Distribution of consolidation patterns by CD4 level among HIV/PTB co-infected patients with AFB sputum smear positive Pulmonary Tuberculosis

CONSOLIDATION	CD4LEVEL (µmol/l)		Total	X^2	p-value
	≥ 200	< 200			
Presence	**N=21**	**N=33**	**N=54**		
Yes	15 (71,4%)	22 (66,7%)	37 (68,5%	0.135	0.713
No	6 (28,6%)	11 (33,3%)	17 (31,5%)		
Type					
Interstitial	**N=15**	**N= 22**	**N=37**		
Yes	9 (60,0%)	11 (50,0%)	20 (54,1%)	0.359	0.549
No	6 (40,0%)	11 (50,0%)	17 (45,9%)		
Alveolar	**N=15**	**N= 22**	**N=37**		
Yes	10 (66,7%)	14 (63,6%)	24 (64,9%)	0.036	0.850
No	5 (33,3%)	8 (36,4%)	13 (35,1%)		
Mixed	**N=15**	**N=22**	**N=37**		
Yes	4 (26,7%)	3 (13,6%)	7 (18,9%)	0.987	0.320
No	11 (73,3%)	19 (86,4%)	30 (81,1%)		
Lung involvement					
Right	**N=15**	**N= 22**	**N=37**		
Yes	10 (66,7%)	11 (50,0%)	21 (56,8%)	1.009	0.315
No	5 (33,3%)	11 (50,0%)	16 (43,2%)		
Left	**N=15**	**N= 22**	**N=37**		
Yes	11 (73,3%)	17 (77.3%)	28 (75,7%)	0.075	0.784
No	4 (26,7%)	5 (22,7%)	9 (24,3%)		
Bilateral	**N=15**	**N= 22**	**N=37**		
Yes	6 (40,0%)	6 (27,3%)	12 (32,4%)	0.659	0.417
No	9 (60,0%)	16 (72,7%)	25 (67,6%)		

HIV/PTB co-infected patients with CD4 levels < 200µmol/l compared to patients with CD4 counts ≥ 200µmol/l had CXRs with lesser consolidation pattern (66.7% vs 71.4%), lesser interstitial consolidation pattern (50.0% vs 60.0%), lesser alveolar consolidation pattern (63.6% vs 66.7%), lesser mixed consolidation pattern (13.6% vs 26.7%), lesser

right lung consolidation pattern (50.0% vs 66.7%), higher left lung consolidation pattern (77.3% vs 73.3%) and lesser bilateral lung consolidation pattern (27.3% vs 40.0%).

No significant association between CD4 levels and presence of consolidation, its type or lung involvement.

Table 8.2: Lung zone distribution of consolidation by CD4 level among HIV/PTB co-infected patients with AFB sputum smear positive Pulmonary Tuberculosis

	CD4 LEVEL(µmol/l)				
CONSOLIDATION	**≥ 200**	**< 200**	**Total**	X^2	**p-value**
Zonal involvement					
Right upper zone	**N=15**	**N=22**	**N=37**		
Yes	6 (40,0%)	7 (31,8%)	13 (35,1%)	0.262	0.609
No	9 (60,0%)	15 (68,2%)	24 (64,9%)		
Right mid zone	**N=15**	**N=22**	**N=37**		
Yes	6 (40,0%)	1 (4,5%)	7 (18,9%)	7.309	0.007
No	9 (60,0%)	21 (95,5%)	30 (81,1%)		
Right lower zone	**N=15**	**N= 22**	**N=37**		
Yes	3 (20,0%)	4 (18.2%)	7 (18,9%)	0.019	0.890
No	12 (80,0%)	18 (81,8%)	30 (81,1%)		
Left upper zone	**N=15**	**N= 22**	**N=37**		
Yes	6 (40,0%)	10 (45,5%)	16 (43,2%)	0.108	0.742
No	9 (60,0%)	12 (54,5%)	21 (56,8%)		
Left mid zone	**N=15**	**N= 22**	**N=37**		
Yes	7 (46,7%)	4 (18,2%)	11 (29,7%)	3.46	0.063
No	8 (53,3%	18 (81,8%)	26 (70,3%)		
Left lower zone	**N=15**	**N=22**	**N=37**		
Yes	7 (46,7%)	9 (40,9%)	16 (43,2%)	0.120	0.729
No	8 (53,3%)	13 (59.1%)	21 (56,8%)		

HIV/PTB co-infected patients with CD4 levels < 200µmol/l compared to patients with CD4 counts ≥ 200µmol/l had CXRs with lesser upper zone consolidation (31.8% vs

40.0%, p=0.609), significantly lesser right mid zone consolidation (4.5% vs 40.0%, p=0.007), lesser right lower zone consolidation (18.2% vs 20.0%, p=0.890), higher left upper zone consolidation (45.5% vs 40.0%, p=0.472), lesser left mid zone consolidation (18.2% vs 46.7%, p=0.063) and lesser left lower zone consolidation (40.9% vs 46.7%, p=0.729).

Table 9.1: Distribution of pulmonary nodules by CD4 level among HIV/PTB co-infected patients with AFB sputum smear positive Pulmonary Tuberculosis.

	CD4 LEVEL (µmol/l)				
Nodules	**≥ 200**	**< 200**	**Total**	X^2	**p-value**
Presence	**N=21**	**N= 33**	**N=54**		
Yes	9 (42,9%)	18 (54,5%)	27 (50,0%)	0.701	0.402
No	12 (57,1%)	15 (45,5%)	27 (50,0%)		
Nodule type	**N=9**	**N=18**	**N=27**		
Micronodules	7 (77,8%)	17 (94,4%)	24 (88,9%)	1.688	0.194
Macronodules	2 (22,2%)	1 (5,6%)	3 (11,1%)		
Lung involvement					
Right	**N=9**	**N=18**	**N=27**		
Yes	9 (100,0%)	14 (77,8%)	23 (85,2%)	2.348	0.125
No	0 (0,0%)	4 (22.2%)	4 (14,8%)		
Left	**N=9**	**N=18**	**N=27**		
Yes	6 (66,7%)	17 (94,4%)	23 (85,2%)	3.668	0.055
No	3 (33,3%)	1 (5,6%)	4 (14,8%)		
Bilateral	**N=9**	**N=18**	**N=27**		
Yes	6 (66,7%)	13 (72,2%)	19 (70,4%)	0.089	0.766
No	3 (33,3%)	5 (27,8%)	8 (29,6%)		

HIV/PTB co-infected patients with CD4 levels < 200µmol/l compared to patients with CD4 counts ≥ 200µmol/l had CXRs with; more nodular pattern (54.5% vs 42.9%, p=0.402), more micronodules (94.4% vs 77.8%) and lesser macronodules (5.6% vs 22.2%) (p=0.194), higher left lung nodular pattern (94.4% vs 66.7%, p=0.055), higher bilateral lung nodules (72.2% vs 66.7%, p=0.766) and lesser right lung nodular pattern (77.8% vs 100.0%, p=0.125).

No statistical significance in type and distribution of lung nodules with respect to CD4 levels.

Table 9.2: Lung zone distribution of pulmonary nodules by CD4 level among HIV positive patients with AFB sputum smear positive Pulmonary Tuberculosis

	CD4 LEVEL (µmol/l)				
Nodules	**≥ 200**	**< 200**	**Total**	X^2	**p-value**
Zonal involvement					
Right upper zone	**N=9**	**N=18**	**N=27**		
Yes	5 (55,6%)	6 (55,6%)	15 (55,6%)	0.000	1.000
No	4 (44,4%)	8 (44.4%)	12 (44,4%)		
Right mid zone	**N=9**	**N=18**	**N=27**		
Yes	8 (88,9%)	12 (66,7%)	20 (74,1%)	1.543	0.214
No	1 (11,1%)	6 (33,3%)	7 (25,9%)		
Right lower zone	**N=9**	**N=18**	**N=27**		
Yes	5 (55,6%)	10 (55,6%)	15 (55,6%)	0.000	1.000
No	4 (44,4%)	8 (44,4%)	12 (44,4%)		
Left upper zone	**N=9**	**N=18**	**N=27**		
Yes	5 (55,6%)	11 (61,1%)	16 (59,3%)	0.077	0.782
No	4 (44,4%)	7 (38,9%)	11 (40,7%)		
Left mid zone	**N=9**	**N=18**	**N=27**		
Yes	5 (55,6%)	16 (88,9%)	21 (77,8%)	3.857	0.050
No	4 (44,4%)	2 (11,1%)	6 (22,2%)		
Left lower zone	**N=9**	**N=18**	**N=27**		
Yes	5 (55,6%)	13 (72.2%)	18 (66,7%)	0.750	0.386
No	4 (44,4%)	5 (27.8%)	9 (33,3%)		
Milliary nodules	**N=9**	**N=18**	**N=27**		
Yes	4 (44,4%)	8 (44.4%)	12 (44,4%)	0.000	1,000
No	5 (55,6%)	10 (55,6%)	15 (55,6%)		

HIV/PTB co-infected patients with CD4 levels < 200µmol/l compared to patients with CD4 counts ≥ 200µmol/l had CXRs with similar distribution of right upper zone nodules, right lower zone nodules and miliary pulmonary nodules, lesser right mid zone nodules (66.7% vs 88.9%, p=0.214); higher left upper zone nodules (61.1% vs 55.6%, p=0.782),

higher left mid zone nodules (88.9% vs 55.6%, p=0.050) and higher left lower zone nodules (72.2% vs 55.6%, p=0.386).

No statistical significance in zonal distribution of lung nodules with respect to CD4 levels.

Table 10.1: Distribution of pulmonary cavities by CD4 level among HIV positive patients with AFB sputum smear positive Pulmonary Tuberculosis

	CD4 LEVEL (µmol/l)				
CAVITY	**≥ 200**	**< 200**	**Total**	X^2	**p-value**
Presence	**N=21**	**N=23**	**N=54**		
Yes	11 (52,4%)	13 (39.4%)	24 (44,4%)	0.877	0.349
No	10 (47,6%)	20 (60.6%)	30 (55,6%)		
Wall thickness	**N=11**	**N=13**	**N=24**		
Thin walled	2 (18,2%)	4 (30,8%)	6 (25,0%)	0.503	0.478
Thick walled	9 (81,8%)	9 (69,2%)	18 (75,0%)		
Lung involvement					
Right	**N=11**	**N=13**	**N=24**		
Yes	7 (63,6%)	6 (46.2%)	13 (54,2%)	0.734	0.392
No	4 (36,4%)	7 (53.8%)	11 (45,8%)		
Left	**N=11**	**N=13**	**N=24**		
Yes	6 (54,5%)	10 (76.9%)	16 (66,7%)	1.343	0.247
No	5 (45,5%)	3 (23.1%)	8 (33,3%)		
Bilateral	**N=11**	**N=13**	**N=24**		
Yes	2 (18,2%)	3 (23.1%)	5 (20,8%)	1.343	0.247
No	9 (81,8%)	10 (76.9%)	19 (79,2%)		

HIV/PTB co-infected patients with CD4 levels < 200µmol/l compared to patients with CD4 counts ≥ 200µmol/l had CXRs with lesser cavitation (39.4% vs 52.4%, p=0.349), lesser right lung cavitation (46.2% vs 63.6%, p=0.392), lesser thick walled cavities (69.2% vs 81.8%) and more thin walled cavities (18.2% vs 30.8%) (p=0.478).

HIV/PTB co-infected patients with CD4 levels < 200µmol/l compared to patients CD4 counts ≥ 200µmol/l had CXRs with more left lung cavities (76.9% vs 54.5%, p=0.247) and higher bilateral lung cavities (23.1% vs 18.2%, p=0.247).

No statistical significance in zonal distribution of lung cavities with respect to CD4 levels.

Table 10.2: Lung zone distribution of pulmonary cavities by CD4 level among HIV positive patients with AFB sputum smear positive Pulmonary Tuberculosis

	CD4 LEVEL (µmol/l)				
CAVITIES	**≤ 200**	**> 200**	**Total**	X^2	**p-value**
Zonal involvement					
Right upper zone	**N=11**	**N=13**	**N=24**		
Yes	4 (36,4%)	4 (30,8%)	8 (33,3%)	0.084	0.556
No	7 (63,6%)	9 (69,2%)	16 (66,7%)		
Right mid zone	**N=11**	**N=13**	**N=24**		
Yes	2 (18,2%)	2 (15,4%)	4 (16,7%)	0.034	0.855
No	9 (81,8%)	11 (84,6%)	20 (83,3%)		
Right lower zone	**N=11**	**N=13**	**N=24**		
Yes	2 (18,2%)	0 (0,0%)	2 (8,3%)	2.579	0.108
No	9 (81,8%)	13 (100,0%)	22 (91,7%)		
Left upper zone	**N=11**	**N=13**	**N=24**		
Yes	4 (36,4%)	6 (46.2%)	10 (41,7%)	0.235	0.628
No	7 (63,6%)	7 (53,8%)	14 (58,3%)		
Left mid zone	**N=11**	**N=13**	**N=24**		
Yes	3 (27,3%)	5 (38.5%)	8 (33,3%)	0.336	0.562
No	8 (72,7%)	8 (61,5%)	16 (66,7%)		
Left lower zone	**N=11**	**N=13**	**N=24**		
Yes	2 (18,2%)	1 (7,7%)	3 (12,5%)	0.599	0.439
No	9 (81,8%)	12 (92,3%)	21 (87,5%)		

HIV/PTB co-infected patients with CD4 levels < 200µmol/l compared to patients with CD4 counts ≥ 200µmol/l had CXRs with lesser right upper zone cavities (30.8% vs 36.4%, p=0.556), slightly lesser right mid zone cavities (15.4% vs 18.2%, p=0.855) and lesser left lower zone cavities (7.7% vs 18.2%, p=0.439)

HIV/PTB co-infected patients with CD4 levels < 200µmol/l compared to patients with CD4 counts ≥ 200µmol/l and PTB had chest radiographs presenting with absence of right

lower zone cavities, more left upper zone cavities (46.2% vs 36.4%, p=0.628) and more left mid zone cavities (38.5% vs 27.3%, p=0.562)

No statistical significance in zonal distribution of lung cavities with respect to CD4 levels.

Table 11: Distribution of lymphadenopathy by CD4 level among HIV positive patients with AFB sputum smear positive Pulmonary Tuberculosis

	CD4 LEVEL (µmol/l)				
	≥ 200	**< 200**	**Total**	X^2	**p-value**
Intrathoracic lymphadenopathy					
Presence	**N=21**	**N=33**	**N=54**		
Yes	11 (54.4%)	21 (63.6%)	32 (59.3%)	0.673	0.412
No	10 (47.6%)	12 (36.4%)	22 (40.7%)		
Hila lymphadenopathy					
Presence	**N=21**	**N=33**	**N=54**		
Yes	11 (52,4%)	21 (63,6%)	32 (59,3%)	0.673	0.412
No	10 (47,6%)	12 (36,4%)	22 (40,7%)		
Distribution	**N=11**	**N=21**	**N=32**		
Unilateral	6 (54,5%)	12 (57,1%)	18 (56,3%)	0.020	0.888
Bilateral	5 (45,5%)	9 (42,9%)	14 (43,8%)		
Mediastinal lymphadenopathy					
Presence	**N=21**	**N=33**	**N=54**		
Yes	4 (19,0%)	5 (15.2%)	9 (16,7%)	0.140	0.708
No	17 (81,0%)	28 (84.8%)	45 (83,3%)		
Distribution	**N=4**	**N=5**	**N=9**		
Unilateral	1 (25,0%)	3 (60,0%)	4 (44,4%)	1.103	0.294
Bilateral	3 (75,0%)	2 (40,0%)	5 (55,6%)		

HIV/PTB co-infected patients with CD4 levels < 200µmol/l compared to patients with CD4 counts ≥ 200µmol/l had chest radiographs presenting with more intrathoracic lymphadenopathy (63.6% vs 54.4%, p=0.412), more hila lymphadenopathy (63.6% vs

52.4%, 0.412), more unilateral (57.1% vs 54.5%) and lesser bilateral (42.9% vs 45.5%) hila lymphadenopathy (p=0.888).

HIV/PTB co-infected patients with CD4 levels < 200µmol/l compared to patients with CD4 counts ≥ 200µmol/l had chest radiographs presenting with lesser mediastinal lymphadenopathy (19.0% vs 15.2%, p=0.708), lesser bilateral (75.0% vs 40.0%) and more unilateral (25.0% vs 60.0%) mediastinal lymphadenopathy (p=0.294).

No statistical significance in distribution of lymphadenopathy with respect to CD4 levels.

Table 12: Distribution of pleural effusion by CD4 level among HIV positive patients with AFB sputum smear positive Pulmonary Tuberculosis

	CD4 LEVEL				
Pleural effusion	**≥ 200**	**< 200**	**Total**	X^2	**p-value**
Presence	**N=21**	**N=33**	**N=54**		
Yes	5 (23,8%)	10 (30,3%)	15 (27,8%)	0.270	0.422
No	16 (76,2%)	23 (69,7%)	39 (72,2%)		
Distribution	**N=5**	**N=10**	**N=15**		
Unilateral	4 (80,0%)	9 (90,00%)	13 (86,7%)	0.288	0.591
Bilateral	1 (20,0%)	1 (10,0%)	2 (13,3%)		

HIV/PTB co-infected patients with CD4 levels < 200µmol/l compared to patients with CD4 counts ≥ 200µmol/l had chest radiographs presenting with more pleural effusion (30.3% vs 23.8%, p=0.422), more unilateral (90.0% vs 80.0%), lesser bilateral (10.0% vs 20.0%) pleural effusion (p=0.591).

No statistical significance in distribution of pleural effusion with respect to CD4 levels.

DISCUSSION

This hospital based cross sectional study involving sputum smear positive newly diagnosed patients with pulmonary tuberculosis aimed at characterisation of chest radiographic patterns before the use of anti-tuberculosis drugs. Study findings depicts estimate of extent of chest radiographic abnormalities in newly diagnosed smear positive patients with pulmonary tuberculosis. Stratification with HIV status and CD4 level was done to determine their effect on chest radiographic presentation of pulmonary tuberculosis.

Among the study population 54 (31.8%) were HIV co-infected. Females were significantly more HIV/PTB co-infected than males ($p = 0.000$). And most of HIV/PTB co-infected patients had CD4 counts less than 200µmol/l.

This study found HIV co-infection among PTB patients was significantly associated with more left ($p = 0.023$) and bilateral ($p = 0.004$) pulmonary nodules on chest radiography. Again HIV co-infection among PTB patients was significantly associated with distribution of pulmonary nodules more in the left upper ($p = 0.028$), mid ($p = 0.039$) and lower ($p = 0.005$) zones and milliary nodules ($p = 0.005$) on chest radiography.

Distribution of pulmonary infiltrates with both typical upper zone and atypical mid and lower zone infiltrations reveal mixed chest radiographic presentation significantly associated with HIV/PTB co-infection. This is different from previous studies in which HIV/PTB co-infection was found to be significantly associated with atypical PTB radiographic presentation only (22, 32, 45). This study is also in contrary with significant less apical infiltrations seen among HIV/PTB co-infected patients in previous studies (38, 45, 56).

Above observed differences may be due to study setting, inclusion criteria, sampling techniques and sample size used. The present study was done at the TB clinic, involved

strictly adult patients with smear positive PTB and had large sample size which was different from previous studies (6, 22, 32, 38, 45, 56).

In the present study left and bilateral pulmonary nodules and milliary nodules signifies diffuse pulmonary spread of tubercle bacilli among HIV/PTB co-infected patients than in PTB only patients (17, 19, 32, 57). This is due to HIV/PTB co-infected patients have increased risk of hematogenous spread of pulmonary primary tuberculosis (19) or coincidental infections ($p < 0.0002$)(46). Higher prevalence and association of milliary nodules with HIV positive status among patients with pulmonary tuberculosis has been observed in previous studies (11, 20, 26, 42).

Lack of significant association between pulmonary nodules and milliary nodules with level of CD4 counts among HIV/PTB co-infected patients is due to chance variation which is contrary with several earlier studies (17, 30, 41).

This study found that HIV co-infection among PTB patients was significantly associated with less alveolar consolidation pattern (p-value = 0.04). Lesser alveolar consolidation among HIV/PTB co-infected patients signifies atypical PTB presentation which had also been observed in previous studies (11, 27, 56). This is due to immune system anergy in HIV positive patients (32, 57).

HIV/PTB co-infected patients with CD4 counts $\geq$ 200µmol/l compared to patients with CD4 levels < 200µmol/l had CXRs with significantly higher right mid zone consolidation ($p=0.007$). This shows presence of atypical radiographic pattern among HIV/PTB co-infected patients is also seen in immune-competent individuals. This is different from previous studies in which presence of atypical radiographic pattern among HIV/PTB co-infected patients was associated with CD4 levels < 200µmol/l (17, 58).

In this study it was found that PTB/HIV co-infected patients had significantly lesser pulmonary cavities on chest radiography than PTB only patients. This explains more atypical radiographic patterns of PTB among HIV/PTB co-infected compared to patients with PTB only due to inadequate immune response in HIV positive patients (32, 57). This is in agreement with significant lesser frequent cavities among the HIV/PTB co-infected patients (8, 10, 11, 19, 25, 27, 39, 40, 46, 56).

Lack of significant association of pulmonary cavities in HIV/PTB co-infected patients with CD4 levels may be due to chance variation of pulmonary cavities with CD4 levels contrary to significant association of pulmonary cavities with CD4 counts $\underline{\geq}$ 200µmol/l in previous studies (8, 19, 28, 30, 33, 38).

Intrathoracic lymphadenopathy, pleural effusion and their distribution were not associated with either HIV/PTB co-infection or CD4 levels may be due to chance variation.

STUDY LIMITATIONS

This is a hospital based study hence results cannot be generalized to general community level. Therefore findings from this study do not reflect to the general population.

Radiographic patterns observed might have been influenced by mixed respiratory infections, *Pneumocystis jirovecii* pneumonia or lung tumours. These were well recognized and were reduced by strict use of inclusion criteria and symptom screening questionnaire.

There was limited number of HIV/PTB co-infected patients that led to absence of association of radiographic patterns with severe immunesuppression.

Lastly during the study period there were times when there was lack of sputum containers and HIV test kits. This led to non enrolment of patients into the study during these circumstances and hence prolongation of the study.

CONCLUSION

Prevalence of HIV among sputum smear positive patients receiving care at TB clinic is still high. Most patients with smear positive pulmonary tuberculosis have abnormal chest radiographs. This study demonstrates that pulmonary cavitation and consolidation are highly associated with negative HIV status. HIV positive patient with smear positive pulmonary tuberculosis are more likely to have left or bilateral pulmonary nodules. Also HIV positive sero-status is associated more with miliary nodules and left upper, mid and lower zone nodules. Right mid zone consolidation in HIV patients was associated with CD4 counts of equal or more than 200µmol/l. There was no radiographic pattern which was significantly associated with severe immunosuppression.

RECOMMENDATIONS

1. It is recommended that all HIV positive patients with pulmonary radiographic lesions to have sputum smear screening.
2. Patients with chest radiographs presenting with pulmonary nodules should be evaluated for pulmonary tuberculosis and HIV.
3. There is a need of more studies focusing on radiographic patterns among HIV positive and HIV negative patients using large community based sample in order to get findings which will reflect to the general population.

AREAS OF FURTHER RESEARCH

The present study is a hospital based study involving patients attending Mwananyamala TB clinic hence a further research can be done focusing on radiographic patterns among HIV positive and HIV negative patients covering all TB clinics of the whole country to assess the magnitude of the problem.

Also a further research can be done focusing on radiographic patterns among HIV positive and HIV negative patients using large community based sample in order to get findings which will reflect to the general population.

There was limited number of HIV/PTB co-infected patients that led to absence of association of radiographic patterns with AIDS hence a further research can be done among HIV/PTB co-infected patients using a large sample to assess radiographic features associated with AIDS among PTB/HIV co-infected patients.

CHAPTER FOUR

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APPENDICES

APPENDIX 1: QUESTIONNAIRE :

PULMONARY RADIOGRAPHIC PATTERNS AMONG ADULTS WITH TUBERCULOSIS ATTENDING MWANANYAMALA MUNICIPAL HOSPITAL FROM JULY TO DECEMBER 2011

PART I: Demographic data

1. Registration no: _____
2. Date of interview: **____/____/_____ (dd /mm/yyyy)**
3. Age _____years
4. Sex
    1. Male
    2. Female
5. Marital status:
    1. Single
    2. Cohabiting
    3. Married
    4. Divorced
    5. Widowed
6. Level of education attained
    1. None
    2. Primary school
    3. Secondary school
    4. Post Secondary

7. What is your occupation?

    1. Informal employment
    2. Formal employment
    3. None

Part II: Patients symptoms

8. Do you have fever for ≥ 2 weeks
    1. Yes
    2. No
9. Do you have cough for ≥ 2 weeks
    1. Yes
    2. No
10. Did you have rapid weight loss?
    1. Yes
    2. No
11. Did you have coughed blood (hemoptysis)
    1. Yes
    2. No

Part III: Chest radiographic patterns

12. Consolidation

    1. Yes
    2. No (Go to question 15)

13. If Yes it is

    1. Interstitial
    2. Alveolar
    3. Mixed

14. Distribution of consolidation

    1. Right lung
        A1. Upper zone
        B1. Mid zone
        C1. Lower zone
    2. Left lung
        A2. Upper zone
        B2. Mid zone
        C2. Lower zone

15. Nodules

    1. Yes
    2. No (Go to question 19)

16. If Yes it is

    1. Micronodules
    2. Macronodules

17. Destribution of nodules

    1. Right lung
        A1. Upper zone
        B1. Mid zone
        C1. Lower zone
    2. Left lung
        A2. Upper zone
        B1. Mid zone
        C1. Lower zone

18. Milliary nodules

    1. Yes
    2. No

19. Cavities

    1. Yes
    2. No (Go to question 22)

20. If Yes

    1. Thin walled
    2. Thick walled

21. Destribution of cavities

    1. Right lung
        A1. Upper zone
        B1. Mid zone
        C1. Lower zone
    2. Left lung
        A2. Upper zone
        B1. Mid zone
        C1. Lower zone

22. Intrathoracic lymphadenopathy

    1. Yes
    2. No (Go to question 27)

23. Hilar lymphadenopathy

    1. Yes
    2. No (Go to question 25)

24. If Yes it is

    1. Unilateral
    2. Bilateral

25. Mediastinal lymphadenopathy

    1. Yes
    2. No (Go to question 27)

26. If yes

    1. Unilateral
    2. Bilateral

27. Pleural effusion

    1. Yes
    2. No (Go to question 29)

28. If yes

    1. Unilateral
    2. Bilateral

29. Pleural thickening

    1. Yes
    2. No

Part IV: Patient's serostatus and CD4 counts.

30. HIV status

    1. Positive, (Go to question 31).

    2. Negative

31. CD 4 counts.....(cells/µl).

    1. Below 200

    2. 200 and above

APPENDIX II: INFORMED CONSENT

I am Dr Musa Balowa postgraduate statudent at Muhimbili University of Health and Allied Sciences (MUHAS). I am doing investigations pulmonary radiographic patterns among adults with Tuberculosis. The aim of this study is to study the role of chest radiograph in detection of radiographic abnormalities in patients with pulmonary tuberculosis.

If you agree to participate in this study, you will be asked questions then chest radiograph will be done immediately. No information from this study will be available to unauthorized individuals. All information collected plus chest x-ray findings will be entered in a computer system and only registration numbers will be used for identification. We don't expect any harm from this study to happen to you.

Taking part in this study is completely voluntary. You can withdraw any time without giving reasons, even if you have already given consent. There will be no penalty on your further medical treatment, you will be treated and followed up as any other patient according to Mwananyamala Municipal Hospital and MNH treatment protocol for people with Tuberculosis.

If you agree to participate you will benefit by having thorough check for any pulmonary lung changes of Tuberculosis on your lungs, which will help the physician to properly plan your management. Knowledge gained from this study will benefit management protocol of other patients with Tuberculosis.

If you have any other questions regarding this study, feel free to contact me, the investigator, Dr. Musa Balowa through telephone number 0713659993 or email address balowamusa@yahoo.com. If you have any questions or concerns about your rights as a participant in this study you could discuss them with the current chairman of the Research

Ethical Committee Prof M. Abood, MUHAS P.O.Box 65001, Phone 2151378 or 0713292617.

Do you agree to participate? (*Tick the response*) .....YES …….NO.

I, ……..have read the consent form and my questions have been answered and I agree to participate in this study.

Signature of Participant……..

Signature of Investigator……

Date of signed consent…….

APPENDIX III: CONSENT: SWAHILI VERSION

FOMU YA RIDHAA YA KUSHIRIKI UTAFITI

Mimi ninaitwa Dr Musa Balowa ni mwanafunzi wa uzamili Chuo Kikuu cha Sayansi za Afya na Tiba Muhimbili. Nina fanya uchunguzi wa magonjwa ya mapafu kwa wagonjwa wenye Kifua kikuu. Dhumuni la utafiti huu ni kuona uwezo wa picha ya kifua (chest x-ray) katika kuonyesha matatizo ya mapafu na kama kuna kisababishi chochote.

Ukikubali kushiriki katika utafiti huu utaulizwa maswali halafu utapigwa picha ya kifua.

Taarifa zote kuhusiana na utafiti huu ni siri na mtu yeyote asiyehusika hataruhusiwi kuziona. Taarifa pamoja na majibu yote yataingizwa kwenye computer kwa kutumia namba yako ya utambulisho. Hatutegemei madhara yoyote yakupate kutokana na utafiti huu.

Ni hiari yako kukubali kushiriki kwenye utafiti huu. Unaweza kujitoa wakati wowote bila kutakiwa kutoa maelezo hata kama ulishathibitisha kushiriki. Hautaadhibiwa au kunyimwa haki yako ya matibabu. Utatibiwa kama wagonjwa wengine wenye Kifua kikuu kufuatana na protokali ya Hospitali ya Mwananyamala na Wizara ya Afya.

Kama ukikubali kushiriki katika utafiti huu utafaidika kwa kuchunguzwa kwa kina kama una dalili matatizo katika mapafu yatokanayo na kuwa na kifua kikuu. Matokeo ya uchunguzi huu yatasaidia katika kuboresha matibabu kwa wagonjwa wengine watakao gundulika kuwa na matizo katika mapafu yatokanayo na kifua kikuu.

Kama una maswali kuhusu utafiti huu wasiliana nami Dr. Musa Balowa Box 65007 Dar es Salaam, nambari ya simu 0713659993 kwa brua pepe balowamusa@yahoo.com.

Kama una maswali yoyote juu ya haki zako katika kushiriki utafiti huu, unaweza kuzungumza na mwenyekiti, Kamati ya utafiti kuruhusu udhamini wa utafiti- Chairman of

Ethical Committee MUHAS Prof M. Abood, S.L.P 65001, Simu: +255 22 2151378 or 0713292617

Je, umekubali kushiriki? .....NDIYO..... HAPANA.....

Mimi……..nimesoma maelezo na maswali yangu yamejibiwa na nimekubali kushiriki kwenye utafiti huu.

Sahihi ya Mshiriki……

Sahihi ya Mtafiti……

Tarehe……