CHEST CT FINDINGS IN HIV

A DESCRIPTIVE CROSS-SECTIONAL STUDY ON THE ABNORMAL PATTERNS ENCOUNTERED ON CHEST CT SCAN IMAGES OF ADULT HIV PATIENTS AT KENYATTA NATIONAL HOSPITAL

DR NDIEMA FAITH TENGAN- M.B.Ch. B (UON)

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DECLARATION

I, Dr. Faith Tengan Ndiema, declare that the work contained herein is my original work and has not been presented for the award of a degree in any other university.

Signature…… Date…….....

Approval by Supervisors

This research proposal has been submitted with full approval as supervisors

Dr. Ian Mathenge Muriithi

MBChB (Nbi) MMed (Nbi)

Consultant radiologist and Lecturer Department of Diagnostic Imaging and Radiation Medicine, University of Nairobi

Signature…… Date…….....

Dr. Beatrice Mulama

MBChB (Nbi) MMed (Nbi)

Consultant radiologist Kenyatta National Hospital

Signature…… Date…….....

DEDICATION

Dedicated to my dear parents, nephews and nieces for all their support and inspiration during my studies.

ACKNOWLEDGEMENTS

I would like to thank my supervisors, Dr. Ian Mathenge and Dr. Beatrice Mulama for all their time and guidance throughout the study.

I am also thankful to all the staff in Kenyatta National Hospital who helped me during the research process.

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LIST OF ABBREVIATIONS

CT-	Computed tomography
HRCT-	High resolution computed tomography
HIV -	Human immunodeficiency virus
AIDS-	Acquired immunodeficiency syndrome
HAART-	Highly active antiretroviral therapy
PCP-	Pneumocystis jirovecii pneumonia
COPD -	Chronic obstructive pulmonary disease
CMV-	Cytomegalovirus
TB-	Tuberculosis
PTB-	Pulmonary tuberculosis
DDIRM -	Department of Diagnostic Imaging and Radiation Medicine
ERC –	Ethics and Research Committee
KNH-	Kenyatta National Hospital
UON -	University of Nairobi
USD-	United States Dollars

DEFINITION OF TERMS

1. ***Bronchiectasis*-**irreversible abnormal dilatation of the bronchial tree
2. ***Emphysema* -** abnormal permanent enlargement of the airspaces distal to the terminal bronchioles
3. ***Consolidation***-Homogenous opacity due to a region of normally compressible lung tissue being filled with liquid instead of air.
4. ***Pleural effusion-***Pleural effusions are abnormal accumulations of fluid within the pleural space.
5. ***Honey combing-*** a CT imaging descriptor referring to clustered cystic air spaces (between 3-10 mm in diameter
6. ***Ground glass opacification-*** Ground-glass opacity (GGO) is a radiological term indicating an area of hazy increased lung opacity through which vessels and bronchial structures may still be seen.
7. ***Tree in bud -*** CT appearance of multiple areas of centrilobular nodules with a linear branching pattern.
8. ***Adenopathy-*** Lymphadenopathy (or adenopathy) is, if anything, a broader term, referring to any pathology of lymph nodes, not necessarily resulting in increased size; this includes abnormal number of nodes, or derangement of internal architecture (e.g. cystic or necrotic nodes)

ABSTRACT

Background

Pulmonary complications of HIV are a major contributor to morbidity and mortality related to the disease as most patients with HIV encounter at least one pulmonary complication in their lifetime. Imaging plays a crucial role in the diagnosis and management of various complications. Chest CT has been shown to be more accurate than chest radiographs in making the diagnosis.

Objective

The main objective of this study was to determine the abnormal patterns encountered on Chest CT images of adult HIV patients at Kenyatta National Hospital.

Methodology

A descriptive observational study was carried out over a period of 6 months from November 2019 to March 2020. Convenient sampling technique was used to identify a total of 91 adult HIV patients who had been referred for chest CT scans. The patients were from the inpatient wards, Comprehensive Care Clinic and Chest Clinic. The patient's demographics such as age and gender were recorded in the data collection tool after signing an informed consent. A brief history of the presenting complaint; duration of presenting illness; use of HAART; smoking history and previous history of TB or pneumonia,was taken and recorded in the data collection tool. The chest CT scan images from each of the patients were then reviewed by the researcher and a consultant radiologist. The findings were reported, and the radiographic patterns encountered were then recorded in a data collection form for each participant.

Data analysis was carried out by Statistical Package for Social Science model SPSS version 23. Demographics were presented as frequency and proportions for categorical variables as well as means and medians. Chi-square test as well as Logistic Regression were used to determine the predictors of having an abnormal radiographic pattern. The findings were presented in the form of texts, charts, graphs and tables.

Utility

This study has great relevance and utility. No previous study has been conducted in Kenya to assess the changes seen in the lungs of HIV patients as seen on chest CT. This study can also be used to determine the predictors of having lung parenchymal changes in HIV patients.

Results

The total number of patients involved in the study was 91. 59.6 % were males while 40.4 % were females. The male to female ratio was 1.47:1 with a male majority of 53 patients.

25.3 % had a history of smoking while 41.8% had a history of pulmonary tuberculosis (T.B). Previous history of pneumonia was reported in 12.1% of the patients. 61% of the patients were on HAART.

The majority,76.9% of the patients had abnormal patterns seen on chest CT. The most common radiographic patterns encountered were bronchiectasis (31.4%), emphysema (21.42%), and ground glass opacities (21.42%). Other patterns seen were nodules (17.1%), consolidation (15.71%) adenopathy (15.71%), tree in bud (14.28%) and cavitation (12.85%). Pleural effusion accounted for 7.14% of the abnormal patterns seen. The least common pattern was honey combing at 4.28%

Age and gender were not found to be predictors of having an abnormal pattern on chest CT.

History of pneumonia and use of HAART were also not found to be statistically significant predictors of having a radiographic abnormality.

History of smoking (OR =9.2, p=0.014, 95% CI =1.2-72.7) and history of pulmonary TB (OR =22.4, p=0.001, 95% CI=2.9-176.4) were found to be significant and independent predictors of having a radiographic abnormality.

Conclusion

Chest CT is an effective tool in imaging patients with HIV as a wide range of imaging patterns can be detected which can significantly aid in the diagnosis of lung pathologies.

HIV patients with either history of pulmonary TB or smoking have a significant and independent increased risk of developing abnormal lung patterns as seen in the above study.

Study Limitations

1. The study was a hospital-based study and therefore cannot be generalized for the whole population.
2. Comparison was not done with CD4 levels as not all patients had current count.

Recommendation:

Future studies can correlate radiographic findings with CD4 level counts and laboratory results. This would better assess the relationship between the radiographic patterns and the level of immune suppression and further assess the pathological causes of the abnormal patterns.

INTRODUCTION

Human immunodeficiency virus belongs to a subset of viruses called lentiviruses or slow viruses. Upon infection the virus enters the blood stream and infects the CD4 cells. Over time the virus replicates leading to depletion of the CD4 cells and resulting in an immunodeficiency syndrome known as Acquired Immunodeficiency Syndrome (AIDS). As a result of the weakened immune system the patient is more vulnerable to opportunistic infections and malignancies. (1)

The first cases of HIV were detected and described in 1981 in patients with lung complications of PCP. Since then it has grown to be a worldwide pandemic with 70 million people having been infected to date. Out of this, 35 million people have died. (2)

Sub Saharan Africa has the highest disease burden accounting for 66 % of new infections. Kenya has of the joint fourth largest epidemic in the world. As of 2017, 1.5 million people were living with HIV in Kenya giving an adult prevalence rate of 4.8%. Out of this 75% of infected adults and 82% of infected children are on HAART. Every year there are 53,000 new HIV infections and 28000 AIDS related deaths in the country. (3)

Respiratory complications of HIV

Since the beginning of the epidemic the lungs have been the chief target organ for HIV. Studies have shown that almost 70% of patients suffer at least one respiratory complication during their illness. (4).

Before the advent of HAART most of the respiratory complications were mainly due to opportunistic illnesses such as infections and malignancies. Currently the spectrum of complications is wider including non-acquired immune deficiency syndrome defining cancers, complications of concomitant illnesses and side effects of HAART. (5) The use of HAART and PCP prophylaxis has resulted in an increase in life expectancy with change in spectrum of pulmonary complications. Studies have shown a decline in pulmonary infections with an increase in noninfectious complications such as COPD and pulmonary hypertension. (6)

Infectious complications may be due to mycobacterium, bacteria, pneumocystis jirovecii pneumonia and fungal infections. Noninfectious complications include HIV associated neoplasms such as Kaposi' sarcoma, pulmonary lymphoma and lung cancer; HIV associated pulmonary hemorrhage, HIV associated pulmonary arterial hypertension, lymphocytic interstitial pneumonia and emphysema. (7)

Tuberculosis is the most common pulmonary infection in Africa, followed by community-acquired pneumonia. Sub Saharan Africa accounts for 79% of all cases of HIV-associated tuberculosis worldwide. Out of this, 39% of persons with tuberculosis in sub-Saharan Africa were estimated to be infected with HIV (8). In Kenya, the prevalence of bacteriologically confirmed pulmonary TB in those ≥15 years was found to be 558 per 100,000 adult population. The HIV PTB co-infection rate was found to be 16.7 % (9)

Despite adequate treatment pulmonary TB may heal producing fibrosis, cavitation and calcification resulting in permanent sequelae in the lungs. (10)

The table below summarizes the chest infections seen in HIV depending on the CD4 count. (11)

TABLE 1 (11):

A) Based of CD4

- CD >400 : Increase risk of
  - Bactetial infection
  - *Mycobacterium tuberculosis*
- CD4 200-400 : Increase risk for
  - Recurrent bacterial infections
  - *Mycobacterium tuberculosis*
  - Lymphoma and Lymphoproliferative disorders
- CD4 <200 : Increase risk for
  - PCP
  - Disseminated *Mycobacerium tuberculosis*
- CD4 <100 : Increase risk of
  - PCP
  - A typical *Mycobacterium tuberculosis*
  - CMV
  - Kaposi's sarcoma
  - Lymphoma

CT imaging of the chest is not routinely done in assessing pulmonary complications in HIV as plain radiographs and clinical findings are usually adequate in making the diagnosis. However previous studies have shown that chest CT is more accurate than plain radiography in making the diagnosis. (12) As a result, several patients also do chest CT as a complimentary study.

Other indications of chest CT may include characterization of nonspecific chest radiograph abnormalities, detection of occult lung disease not seen on plain radiograph, evaluation of the mediastinum, staging of malignancy, assessing complications, and guiding interventional procedures. The adult radiation dose in chest CT is 2-8 mSv.

There is considerable overlap in the radiographic patterns in making the diagnosis. Therefore, it is necessary to correlate the radiographic findings with the patient clinical features as well as the level of immune compromise, as represented by the CD4 count, to make an accurate diagnosis.

Some of the common radiographic patterns that may be encountered in chest CT of HIV patients include nodules, consolidation, bronchiectasis, ground glass opacity, emphysema, tree- in- bud opacities, honeycombing and pleural effusion.

The table below summarizes the common radiographic patterns seen in HIV related chest infections.

HRCT Imaging patterns	Associated infections
Nodules	Viral pneumonia, septic emboli, invasive aspergillosis, candidiasis CMV pneumonia, TB.
Consolidation	Bacterial pneumonia, pneumococcus, klebsiella, legionella, bronchopneumonia (staphylococcus), pulmonary TB.
ground glass opacity	Pneumocystis pneumonia, CMV.
Tree in bud	Obliterative bronchiolitis, TB

TABLE 2: Common CT radiographic patterns in frequent immunocompromise related infections.

LITERATURE REVIEW

A previous study was done at the University of Pittsburg whereby 121 patients with HIV underwent chest CT scans (13). A majority (55.4%) had radiographic abnormalities. The most common were emphysema (26.4%), nodules (17.4%), and bronchiectasis (10.7%). Age history of pneumonia and smoking were significant predictors of having radiographic abnormalities. Antiretroviral therapy use, CD4 cell count, and HIV viral load did not seem to predict risk.

A study done by Kumar et al (14)on ' HRCT Evaluation of Lung Parenchymal Changes in Symptomatic HIV-Seropositive Individuals' showed that out of 61 HIV positive symptomatic patients 63.9% of patients were identified to have airspace nodules followed by lymphadenopathy in 57.4% cases while 42.6% of patients were identified to have consolidation. Variable size cavities were found in 13.1% of patients. Ground-glass opacity and lung cyst were evident in 19.7% and 6.5% of patients. Bronchiectasis was noted in 31.1% of patients respectively.

RADIOGRAPHIC PATTERNS

Pulmonary nodules

Causes of pulmonary nodules in HIV include opportunistic infections and malignancies. A study was done by Jasmer RM et al. to determine the cause of pulmonary nodules in 242 HIV positive patients at San Francisco General Hospital (15). Out of 242 patients, 87 (36%) had 1 or more pulmonary nodules. The commonest causes were opportunistic infections in 57; bacterial pneumonia (30 patients) and tuberculosis (14 patients). Eleven patients had Kaposi's sarcoma, 10 had lymphoma, and 4 had lung cancer.

Emphysema

Emphysema is one of the entities grouped as chronic obstructive pulmonary disease. In a study done by JE Kulman et al, CT scans of 55 HIV positive patients were reviewed for evidence of bullous pulmonary damage. It found that 42% (23 of 55) of patients had CT evidence of pulmonary bullous change. (16)

Cavities

Most chest cavities in HIV are due to infections such as pulmonary TB, septic emboli and aspergillosis. PCP may also atypically present with cavities. Noninfectious cavitary lung lesions are less common and may be due to malignancies

A 14-year study done by C.Y Lin et al in Taiwan showed that out of 1790 HIV infected patients, cavities were detected in plain radiographs and CT scans of 66 patients (3.7%). The most common aetiology were fungi (42%), bacteria (29.6%) and mycobacteria 25.9%. (17)

Bronchiectasis

Bronchiectasis is defined as abnormal dilatation of the bronchial tree that is irreversible. It may result from obstruction or repeated insults due to infection and inflammation.

In a study by M.A King et al (18) sixty-one subjects, 50 of whom were HIV-positive and 11 of whom were HIV-negative, underwent thin-section CT, BAL, and pulmonary function tests. Eighteen of the 50 HIV-positive subjects and none of the HIV-negative subjects had bronchial dilatation revealed by CT.

Adenopathy

Mediastinal lymphadenopathy has previously been seen to occur in 30- 40% of patient with HIV.

Study done by Jasmer RM et al showed out of 318 HIV positive patients, 110 (35%) had lymphadenopathy on chest CT. Out of these 110 patients, mycobacterium was the cause in 31 cases of cavitation, bacterial pneumonia in 26 cases, and lymphoma in 21 cases. (19)

In different study by Joanna Alcada, two hundred seventy-one consecutive HIV patients underwent Chest CT in the study period. Intrathoracic lymphadenopathy was seen in 52 of the 271 patients (20).

Effusion

Two-thirds of pleural effusions in HIV result from infectious causes, with the remainder resulting from a variety of noninfectious causes such as malignancies, hypoalbuminemia and heart failure (21).

PREDICTORS OF RADIOGRAPHIC ABNORMALITIES

Smoking

In some countries smoking prevalence has been found to be high in the HIV infected population (22). Both HIV and smoking lead to suppression of local lung defenses resulting in a number of complications such as pneumonia and tuberculosis (23). It has also been associated with an increased risk of lung cancer lung cancer and emphysema.

History of pulmonary TB

Pulmonary TB is also a global health problem. Despite adequate treatment the disease may heal with fibrosis, cavitation and calcification resulting in permanent sequelae in the lungs. (24)

In a study by Jianmin Jin et al a total of 231 COPD patients were consecutively enrolled. The percentage of patients with CT bronchiectasis was higher in those with previous PTB (64.4%) compared with those without previous PTB (39.4%, $p<0.001$). The prevalence of emphysema between patients with and without previous PTB showed no significant difference. (25)

HAART

The use of antiretrovirals has resulted in an increase in life expectancy and change of spectrum of lung conditions. Complications such as COPD, pulmonary hypertension and lung cancer are now more commonly seen. (26)

History of pneumonia

A study by E. Clausen on 'Chest Computed Tomography Findings in HIV-Infected Individuals in the Era of Antiretroviral Therapy' showed that previous history of pneumonia was a significant predictor of having a radiographic abnormality (27).

STUDY JUSTIFICATION

Imaging plays an important role in the diagnosis and management of lung complications in HIV alongside clinical features and bronchoscopy findings. No previous study has been done in Kenya to evaluate the changes seen on chest CT of HIV patients.

PROBLEM STATEMENT

Most patients with HIV encounter at least one pulmonary complication at one point in their lives. Consequently, pulmonary manifestations of HIV are a major contributor to mortality related to the disease.

The differentials of pulmonary diseases in HIV patients is wide. Therefore, the imaging findings, severity of immunosuppression and clinical findings should help narrow down the diagnosis. In the advent of HAART and PCP prophylaxis there has also been a change in the spectrum of pulmonary complications in HIV.

OBJECTIVES

MAIN OBJECTIVE

To determine the abnormal chest CT patterns found on chest CT scans of adult HIV AIDS patients at Kenyatta National Hospital.

SPECIFIC OBJECTIVES.

To describe the abnormal CT patterns seen in chest CT images of adult HIV patients at Kenyatta National Hospital.

To determine the predictors of having abnormal chest CT patterns in HIV patient at Kenyatta national hospital.

RESEARCH METHODOLOGY

Study Design

An observational study was carried out by observing the abnormal patterns seen on chest CT images of adult HIV patients at Kenyatta National Hospital.

Study Duration

The study was carried out over a period of 6 months.

Study Area

The study was carried out in Kenyatta National Hospital. Images were obtained from the radiology department, wards, Comprehensive Care Centre and chest clinic.

Study population.

The study included all symptomatic adult HIV positive patients with chest CT scan images.

Inclusion Criteria

All symptomatic adult HIV positive patients with Chest CT scans.

Exclusion Criteria

Participants unable to give consent.

Patients under 18 years of age.

Sample size

The sample size was calculated based on the formula:

$$n = \frac{z^2{}_\alpha \, P(1-P)}{d^2}$$

Where:

z = 1.96 (standard normal deviate representing 95% level of confidence)

P = proportion

d = proportion of sampling error

$$n = \frac{1.96^2 \times 0.26(1-0.26)}{0.05^2}$$

n = 298

nf=91.

Sampling Method

Convenience sampling method was used where all patients meeting the inclusion criteria and consenting were included.

Sampling Procedure

HIV patients who had been referred for chest CT were identified. Consent was obtained from the patients. A brief history on presenting illness, use of HAART, previous history of TB, pneumonia and smoking was taken. A review of the chest CT images was then done, and the findings on abnormal patterns recorded in the data collection tool.

ETHICAL CONSIDERATIONS

Permission to start the study was sought from KNH administration and the Ethics and Research Committee of KNH- UoN, DIRM department /KNH radiology department.

Written informed consent was received from the participants.

Confidentiality was maintained.

Data collected was accessible to the principle investigator, research assistant, statistician, and my supervisors only.

DATA MANAGEMENT AND ANALYSIS

Data collection, Imaging and Evaluation

Data was collected through structured questionnaires which were filled by the principal investigator. Data collected included socio demographics, HIV status, clinical signs and symptoms, history of cigarette smoking and history of previous illness. The radiographic patterns demonstrated on the chest CT scans were also recorded.

Quality control

The images were assessed independently by the principle researcher and a consultant radiologist. The findings were then compared, and a conclusion arrived at together. This was to reduce inter-observer variability.

Data analysis

Demographics have been presented as frequency and proportions for categorical variables as well as means and medians.

Use of Chi-square test as well as Logistic Regression was used to determine the predictors of having a radiographic abnormality.

Findings have been presented in the form of texts, graphs, and tables.

RESULTS

A total of 91 chest CT images were reviewed. The patients' ages ranged from 23 to 83 years. The distribution of these patients by age and sex is shown in the table below.

Table 3: Patient Characteristics

Characteristics	Frequency (N)	Percent (%)
Age in years		
≤30	6	6.7
31-40	10	11.2
41-50	30	33.7
51-60	25	28.1
>60	18	20.2
Gender		
Male	53	59.6
Female	36	40.4

The mean age of the patients was 49.7 (SD 11.9) years, while the median age was 50.0 (IQR 42-58) years. The minimum age was 23 years while the maximum age was 82 years.

Figure 1: Age Distribution

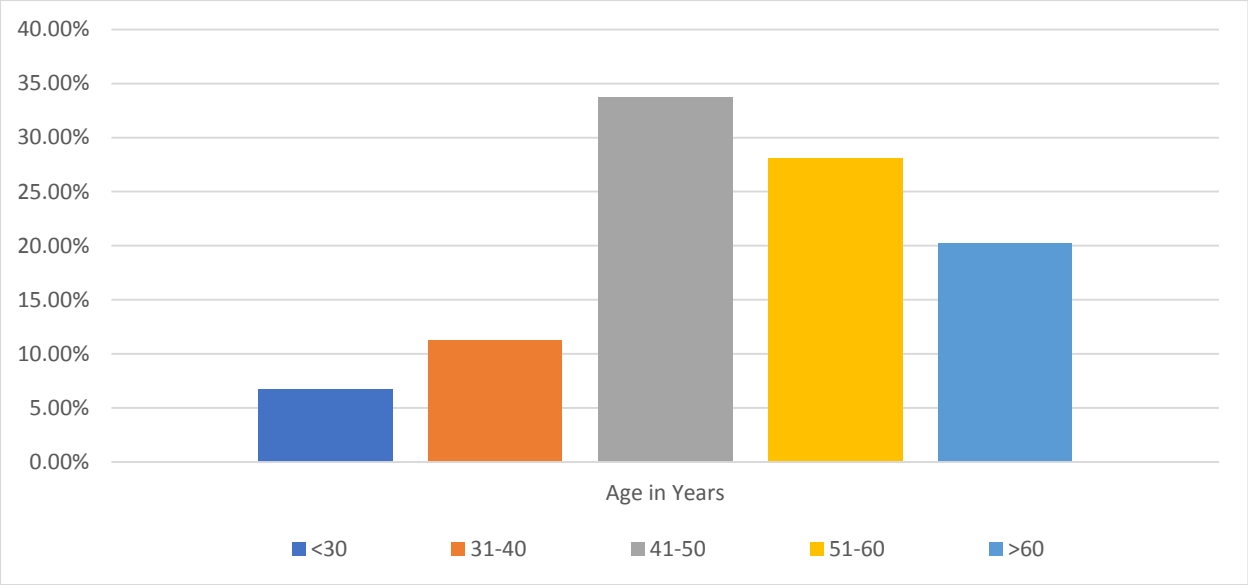

Table 4: Patients History

A brief history was taken to determine predictors of having radiographic abnormalities. The results are as shown:

	Frequency n (%)	
	Yes	**No**
Smoking	23 (25.3)	68 (74.7)
TB	38 (41.8)	53 (58.2)
Pneumonia	11 (12.1)	80 (87.9)
HAART	61 (67.0)	30 (33.0)

Radiographic Abnormalities

Out of a total of 91 patients, 70(76.9%) were found to have had a radiographic abnormality while 21(23.1%) did not have a radiographic abnormality.

Table 5: Radiographic Abnormality

Abnormality	**Frequency (N)**	**Percent (%)**
Yes	70	76.9
No	21	23.1

The frequency of the radiographic abnormalities is as shown:

Table 6: Radiographic Abnormality

Abnormality	Frequency (N)	Percent (%)
Adenopathy	11	15.71%
• Hilar adenopathy	6	
• Mediastinal adenopathy	3	
• Paratracheal adenopathy	2	
Effusion	5	7.14 %
• Pulmonary T.B.	2	
• Lobar pneumonia	1	
• Kaposi's sarcoma	2	
Bronchiectasis	22	31.4%
• COPD	8	
• Pulmonary tb	14	
Emphysema	15	21.42%
• COPD	8	
• Pulmonary T.B.	7	
Honey combing	3	4.28%
Cavitation	9	12.85%
Nodules	12	17.1%
• Granulomatous nodules	6	
• Miliary nodules	4	
• Kaposi's sarcoma	2	
Consolidation	11	15.71%
• Lobar pneumonia	7	
• Bronchopneumonia	4	
Ground glass opacities	15	21.42%
Tree in bud nodules	10	14.28%

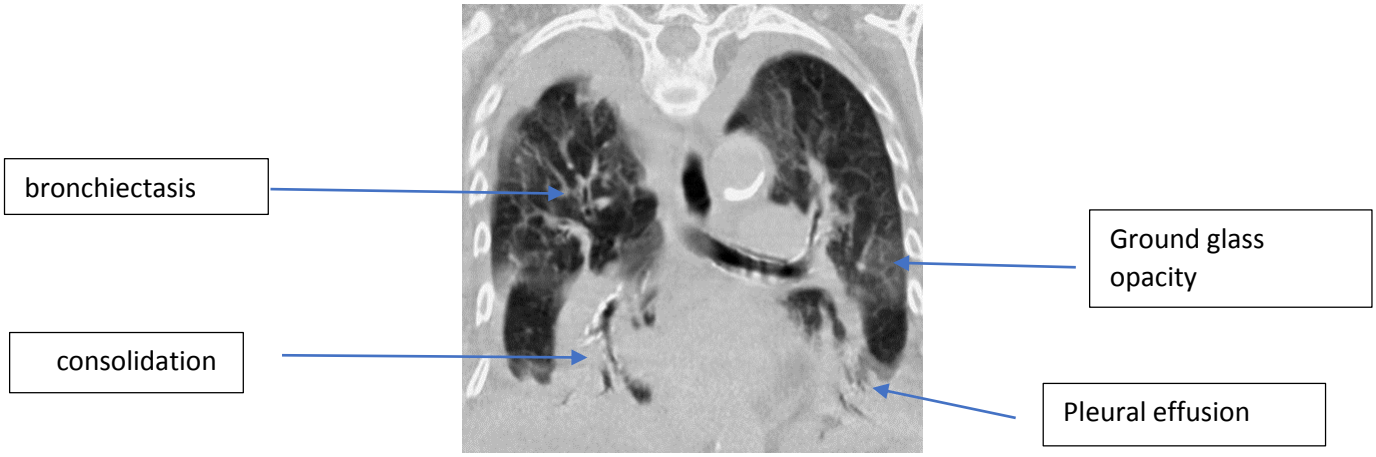

Image 1: showing multiple abnormal patterns

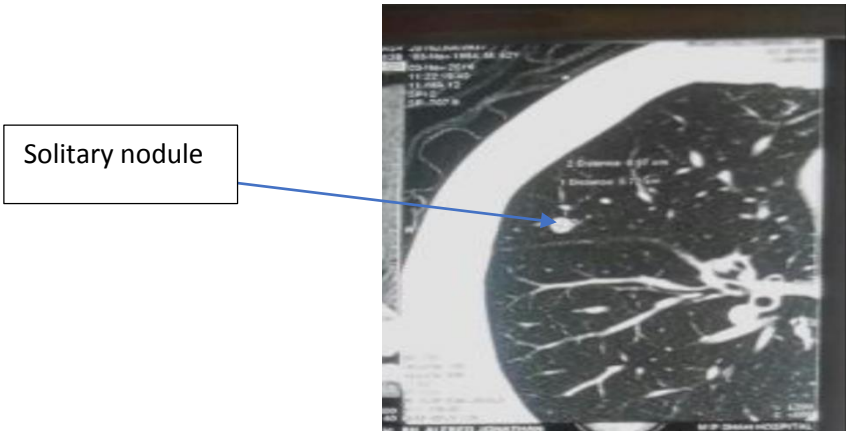

Image 2: showing a solitary pulmonary nodule

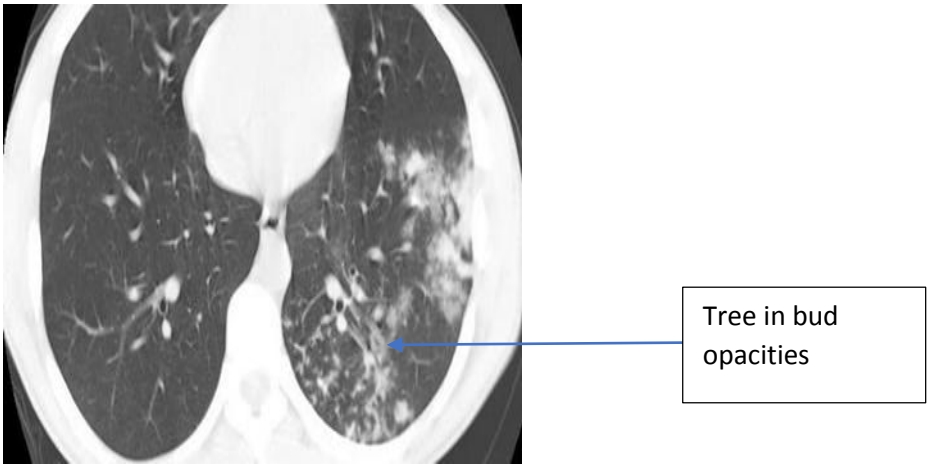

Image 3: showing tree in bud opacities

Table 7: Predictors of Having a Radiographic Abnormality

Chi square test was used to determine the factors that could predict having a radiographic abnormality.

	Radiographic Abnormality				
Characteristic	**Yes**	**No**	**Total**	**COR (95% CI)**	**p-value**
Age					
<40	10 (14.3)	5 (23.8)	15 (16.5)	1.9 (0.6-6.3)	0.324
≥40	60 (85.7)	16 (76.2)	76 (83.5)	Ref	
Gender					
Male	43 (61.4)	11 (52.4)	54 (59.3)	1.4 (0.5-3.9)	0.459
Female	27 (38.6)	10 (47.6)	37 (40.7)	Ref	
History of smoking					
Yes	22 (31.4)	1 (4.8)	23 (25.3)	9.2 (1.2-72.7)	**0.014**
No	48 (68.6)	20 (95.2)	68 (74.7)	Ref	
History of TB					
Yes	37 (52.9)	1 (4.8)	38 (41.8)	22.4 (2.9-176.4)	**0.001**
No	33 (47.1)	20 (95.2)	53 (58.2)	Ref	
History of Pneumonia					
Yes	9 (12.9)	2 (9.5)	11 (12.1)	1.4 (0.3-7.1)	1.000
No	61 (87.1)	19 (90.5)	80 (87.9)	Ref	
Patient on HAART					
Yes	47 (67.1)	14 (66.7)	61 (67.0)	1.0 (0.4-2.9)	1.000
No	23 (32.9)	7 (33.3)	30 (33.0)	Ref	

History of smoking was significantly and independently associated with a radiographic abnormality with the odds of having an abnormality being 9 times more than those without a history, a history of TB was also significantly and independently associated with a radiographic abnormality with the odds of having an abnormality being 22 times more than those without a history.

Table 8: Logistic Regression

Variable	β	AOR (95% CI)	p-value
Smoke (Yes)	2.2	8.8 (1.1-73.9)	**0.045**
TB (Yes)	3.1	21.9 (2.7-175.4)	**0.004**

Logistic regression was run to predict if a patient is likely to have an abnormal radiographic abnormality. The predictors that were found independently to be significant at univariate analysis i.e. history of smoking and history of TB were added to the model to determine how together they would predict if a patient would have a radiographic abnormality. Patients who had a history of smoking were 9 times more likely to have an abnormal radiographic abnormality than those didn't, while those patients that had a history of TB were 22 times more likely to have an abnormal radiographic abnormality than those without a history of TB. The adjusted odds ratios for the predictors i.e. history of smoking and history of TB did not appear to have changed from the crude odds ratio at univariate analysis

DISCUSSION

Ninety-one (91) patients were involved in the study. The patients' ages ranged from 23 to 83 years. The majority were in the 40-50 age group and 50-60 age group, both accounting for a total of 61.9%. Patients less than 30 years accounted for only 7.7%. The male to female ratio was 1.47:1 with males being a majority at 59.6%. This correlates well with previous studies by Kumar et al and Godavarthi et al that also had males as a majority.

25.3% of the patients were found to have had a smoking history. The smoking prevalence is higher than that of the general adult Kenyan population (7.9%). This is comparable to a study done by Tesoriero JM et al which showed the prevalence of smoking being 2-3 times higher in HIV patients compared to the general population.

41.8% of the patients had a previous history of pulmonary TB while 12.1 % of the patients had a previous history of pneumonia. This in keeping with previous studies that showed pulmonary TB to be the commonest pulmonary complication occurring in HIV patients in sub Saharan Africa.

61 % of the patients were on HAART at the time of the study. The coverage is slightly lower than the national coverage of HAART which is at 68% of HIV infected persons. This might be attributed to the study being in a hospital setting rather than one done on the general population.

Out of 91 patients, the majority,76.9%, had a radiographic abnormality. This finding correlates to a study by Godavarthi et al whereby 76.36% of patients had positive radiographic findings on CT.

Bronchiectasis was the most common radiographic abnormality at 31.4%. It was mainly noted in patients with previous history of TB or smoking. A previous study by M.A king et al showed that bronchial dilatation occurred in 36 % of HIV patients.

The second most common pattern seen were emphysema and ground glass opacification each at 21.42%. The prevalence of emphysema is similar a study done by E. Clausen et al that noted emphysema in 26.4 % of HIV patients and ground glass opacity was seen in 8.3%. Out of the patients 15 patients with emphysema, 9 had COPD while 6 had pulmonary T.B. Ground glass opacity was mainly seen in cases with lobar pneumonia (4), tuberculosis (7) and PCP (1). It was also seen in cases of Kaposi's Sarcoma (3).

Nodules were seen in 17.1% of the patients. This corresponds to the study done at the University of Pittsburgh that noted nodules to occur in 17.4%. Granulomatous pulmonary nodules were the most common finding. Other nodules seen were miliary nodules in T.B and flame shaped nodules characteristic of Kaposi's sarcoma

Adenopathy and consolidation were each seen in 15.71%. A study by Joanna Alcada et al showed adenopathy occurred in 19.18% of HIV patients. Hilar adenopathy was the commonest form of adenopathy followed by mediastinal adenopathy. Paratracheal adenopathy was noted in two cases. Lobar pneumonia and bronchopneumonia both accounted for the consolidation. Consolidation was previously noted to occur in 23.33% of patients in the study done by Godavarthi et al.

Tree in bud opacities, commonly seen in obliterative bronchiolitis and pulmonary TB, were noted in 14.28% of cases. No previous study has been done to show the prevalence of tree in bud pattern in HIV patients.

Pleural effusion accounted for 7.14 % of the radiographic abnormalities. This correlates to the study by Godarvathi et al which showed pleural effusion to occur in 6.7%.

The least common abnormality was honey combing seen in 4.28% of the patients with radiographic abnormalities. This was mainly basal and peripherally located. All patients with honey combing had a previous history of smoking. The results are close to a study done by Kumar et al showed honeycombing occurred in 2 out of 61 patients (3.27%)

On analysis of the predictors of having a radiographic abnormality, age and gender were not found to be statistically significant predictors of a radiographic abnormality .In the study by E Clausen et al gender was not found to be a predictor of having a radiographic abnormality, however, age was found to be statistically significant.

History of smoking and pulmonary tuberculosis were found to be significant and independent predictors of having an abnormal pattern on chest CT. This finding is similar to that of E Clausen et al whereby history of smoking was also found to be a predictor. The study, however, did not assess previous history of pulmonary T.B.

Previous history of pneumonia was not found to be a predictor of having a radiographic abnormality. This finding differs from that of E Clausen et al which found pneumonia to be a

predictor of having a radiographic abnormality (O.R=3.60, 95% CI =1.27–10.20, p=0.016). This might due to the low number of patients in my study who reported having been treated for pneumonia in the past.

Use of HAART was also not statistically found to be a predictor of having a radiographic abnormality. This contributes to evidence by previous studies which showed no difference the prevalence of radiographic abnormalities pre and post HAART era.

CONCLUSION.

Chest CT is an effective tool in imaging patients with HIV as a wide range of imaging patterns can be detected which can significantly aid in the diagnosis of lung pathologies.

HIV patients with pulmonary TB or smoking history have a significantly increased risk of developing abnormal lung patterns as seen in the above study.

Study Limitations

1.The study was a hospital-based study and therefore cannot be generalized for the whole population.

2. Comparison was not done with CD4 levels as not all patients had current count.

Recommendation:

Future studies can correlate radiographic findings with CD4 level counts and viral load. This would better assess the relationship between the radiographic patterns and the level of immune suppression and further assess the pathological causes of the abnormal patterns.

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