***Original Research Article***

TITLE:

# Radiologic pattern of sputum-positive Pulmonary Tuberculosis (PTB) among immunocompetent patients in Gwagwalada, Nigeria.


**ABSTRACT**

**Background:**The radiologic knowledge of tuberculosis-associated lung disease is an essential tool in the clinical diagnosis and managementof tuberculosis, a disease that is still a big challenge to Nigeria and Africa at large. Chest radiogram is cheap and readily available,and usually the first imaging modality for the evaluation of patients with sputum positive pulmonary tuberculosis**Objective:**To determine the radiologic pattern of sputum-positive PTB among immunocompetent patients in Gwagwalada, Nigeria. **Methods:**A cross-sectional study spanned sixteen months,involving one hundred adult patients recently clinically diagnosed of pulmonary Tuberculosis were recruited and underwent chest radiographic examination with 14 × 17-inch or 17 × 17-inch image sizes for evaluation of pulmonary tuberculosis.**Results:**Of the 100 patients that underwent chest radiographs, ten patients (10.0%) had normal chest radiographs while varying degree of abnormal chest radiographic findings were seen in the remaining 90 (90%) patients. Fibrotic lesion were present in 45 (45.0%) of patients. There were 60 male and 40 female patients witheight males withnormal chest radiogram. Fibrosis was the predominant radiological feature with 45 (45.0%) of all the patients examined in this study. The prevalence of other findings was: consolidation, 11 (11.0%); lung collapse, (11.0%); cavitation, (11.0%); pleural effusion, (7.0%) and lung infiltrate, (5.0%). Multiple lung cavities and military lesions were not observed in any patient. Cavities were present in 11 (11.0%) and all were solitary and located in the upper lung zone(s).**Conclusion**: Pulmonary tuberculosis is endemic in our environment and evaluation of radiology features in immunocompetent individual is encouraged in developing countries. Sequelae of tuberculosis such as fibrosis was frequently seen in this study which points to late presentation, therefore more public health advocacy are needed against pulmonary tuberculosis.



**Key Words**: Pulmonary tuberculosis, chest radiogram, Radiologist, Gwagwalada, Abuja.


**INTRODUCTION**

Tuberculosis,more than any other infectious disease, has always been a challenge, since it has been responsible for a great amount of morbidity and mortality in humans(1). The large and rapidly growing numbers of patients with tuberculosis in Africa is a source of concern. Intra- and inter- country conflicts, immigration crisis and poverty are responsible for the re-emergence of diseases. Diagnostic techniqueranges from clinical, laboratory and radiologic methods. Coordinated programs and integration of TB management is a key strategy that will improve the diagnosis, treatment, and outcome for patients with Tuberculosis (1,2).

The radiologic diagnosis/assessmentof tuberculosis-associated lung disease is an essential tool in the clinical diagnosis of tuberculosis(2). Chest radiography is the primary imaging method, but the importance of CT is still increasing, as CT is more sensitive in the detection of cavitation,hilar and mediastinallymphadenopathy, endobronchial spread and other complications in the course of the disease. Chest radiography is simple, cheap and readily accessible to patients in resource poor countries. Chest radiography provides essential information for the management and follow up of these patients and is extremely valuable for monitoring complications(3,4).

The most important denominator with regards to presentation is the immune status of the patient with antecedent change in the epidemiology of the disease. This change in the epidemiological picture has several causes, of which the AIDS epidemic, the progression of poverty in developing countries, armed conflicts and the emergence of multidrug-resistant tuberculosis are the most likely culprits. Mainly due to this epidemiological change, the radiological patterns of the disease are also being altered, not conforming to the classical distinction between primary and post primary disease pattern and atypical presentations in groups with an altered immune response being increasingly reported. Therefore the morphologic spectrum of tuberculosis clinico-radiologic is quite variable but early diagnosis of tuberculosis is essential to achieve an efficient therapeutic outcome and to prevent further spread of the disease(4-6).

The global impact of TB is extremelyimportant, considering that an estimated 9.0 million people developed TB in 2013 and 1.5 million died from the disease, according to the recent World Health Organization (WHO) global tuberculosis report 2014. Radiologically, primary PTB manifests as four main entities – parenchymal disease, lymphadenopathy, pleural effusion, and miliary disease – or any of thecombination. Multilobar consolidation can be seen in almost 25% of cases and with calcification in up to 15%. In post primary Tb,cavitation isradiographically evident in 20–45% of patients.Pleural effusion is seen in approximately one-fourth of patients with primary PTB and in 18% of post-primary PTB (7-9).The cost of treatment keeps increasing which includes the treatment of the disease

and its complications(9-12).This study set out to evaluate the importance of chest radiograph in the diagnosis and monitoring of patients withsputum positive*Mycobacterium tuberculosis* infection in resource poor setting.

**Aim**

The aim of the study was to determine the radiologic pattern of sputum-positive PTB among immunocompetent patients in Gwagwalada, Nigeria.

**METHODOLOGY**

**Study background**

This was a cross – sectional study which spanned sixteen (16) months involving one hundred (100) subjects, conducted at the Department of Radiology, University of Abuja Teaching Hospital, Gwagwalada, Abuja, Federal Capital Territory (F.C.T), Nigeria.

**Study population**

Consecutive adult patients with positive history of tuberculosis, who were recently clinically diagnosed of pulmonary tuberculosis were recruited and underwent chest radiographic examination for evaluation of pulmonary tuberculosis.

**INCLUSION CRITERIA:**

i. Sputum/ alveolar lavage/gastric positivity via acid-alcohol fast bacilli using Ziehlneelsen stain (ZN)
ii. HIV seronegative patients
iii. No prior history of active tuberculosis.

**EXCLUSION CRITERIA:**

i. Patient who decline to participate in the study.
ii. Extrapulmonary tuberculosis.
iii. Pregnant women.
iv. Patient with otherconcommited immunosuppressive disorders

**Radiographic examination**

The subjects received formal chest radiographic examinationusing X-ray machine Shimadzu BR-120M Koyoto Japan with imaging parameters of 14 × 17-inch or 17 × 17-inch image sizes; maximum tube currents of 650 mA; usual exposure amount of 1 or 2 mAs; tube voltage of 100-120 kVp; focal spot size of 1.2 mm; detector-focus distance of 183 cm. Chest radiographic examinations were performed by the postero-anterior and lateral views. The films generated were reviewed by two consultant radiologist and areas of divergent views were resolved by a senior radiologist.

**Data Analysis**

Data were analyzed using SPSS 16.0 software. The chi square-test and Fischer exact test were used to perform and establish any statistical difference. Probability values of <0.05 was considered as statistically significant.

**RESULTS**

All the one hundred clinically diagnosed for PTB were acid fast bacilli smear positive for *Mycobacterium tuberculosis*. Of the 100 patients that underwent chest radiographs, ten patients (10.0%) had normal chest radiographs while varying degree of abnormal chest radiographic findings were seen in the remaining 90 (90%) patients. This difference was statistically significant ($p<0.05$). Their ages ranged between 21 and 70 years with a mean of 42.8 years ±11.5.The highest proportion of subject falls within the age range of 41-50 years accounting for 33.0% of the subjects and the lowest proportion being 20-30 years accounting for 12.0% of the subjects studied (Table 1).

There were 60 male and 40 female patients with eight males with normal chests radiogram(Table 2). Fibrosis was the predominant radiological feature with 45 (45.0%) of all the patients examined in this study. The prevalence of other findings was: consolidation, 11 (11.0%); lung collapse, (11.0%); cavitation, (11.0%); pleuraleffusion, (7.0%) and lunginfiltrate, (5.0%). Multiple lung cavities and military lesions were not observed in any patient. Cavities were present in 11 (11.0%) and all were solitary and located in the upper lung zone(s). There was no hilar lymph node enlargement in all the patients radiologically examined (Table 3).

Upper lung zone lesions were predominantly observed in 56 (62.2%) of thepatients while lesions with lower lung zone predominance were observed in 34 (37.8%) of total patients examined. This was statistically significant ($p<0.05$). Among all the patients with upper lobe lesion, six (10.7%) presented with radiologic features of consolidation, seven (12.5%) with lungs collapse and all the patients with cavities. Out of the 45 cases with fibrosis, 30 (53.6%) of the lesion were found in the upper zones compare to 15 (44.1%) patients with lower lung zone

fibrosis. This was statistically significant ($p<0.05$) (Table 3). Consolidation was found in 11 patients recruited, nine unilaterally (six on the left, three on the right) and two bilaterally. All other lung lesions were unilateral.

**Table 1: Age distribution and radiological findingsamong immunocompetentsubject in Gwagwalada.**

| Age (Years) | Freq. | Percent (%) | Normal Chest | Fibr | Collapse | Consolid. | Cavit | Pleura |
|---|---|---|---|---|---|---|---|---|
| 20 – 30 | 12 | 12.0 | 0 | 8 | 1 | 0 | 1 | 2 |
| 31 – 40 | 26 | 26.0 | 2 | 7 | 1 | 2 | 1 | 0 |
| 41 – 50 | 33 | 33.0 | 3 | 13 | 3 | 2 | 0 | 2 |
| 51 – 60 | 16 | 16.0 | 2 | 5 | 2 | 3 | 2 | 2 |
| 61 – 70 | 13 | 13.0 | 3 | 12 | 4 | 7 | 7 | 1 |
| **Total** | **100** | **100.0** | **10** | **45** | **11** | **11** | **11** | **7** |

Key:

Freq. = Frequency

Fibr = Fibrosis

Consolid = Consolidation

Cavit = Cavitation

**Table 2: Sex distribution among immunocompetentsubject in Gwagwalada.**

| Gender | Frequency | Percent | Normal Chest | Abnormal Chest Findings |
|---|---|---|---|---|
| Male | 60 | 60.0 | 8 (80.0%) | 52 (57.0%) |
| Female | 40 | 40.0 | 2 (20.0%) | 38 (42.0%) |
| **Total** | **100** | **100.0** | **10** | **90** |

**Table 3: Pattern of radiological findings in immunocompetent subjects in Gwagwalada.**

| Radiology features | Frequency | Percent | Upper zone | Lower zone |
|---|---|---|---|---|
| Fibrosis | 45 | 45.0 | 30 (53.6) | 15 (44.11) |
| Consolidation | 11 | 11.0 | 6 (10.7) | 5 (14.7) |
| Collapse | 11 | 11.0 | 7 (12.5) | 4 (11.8) |
| Cavitation | 11 | 11.0 | 11 (19.6) | 0 (0.0) |
| Effusion | 7 | 7.0 | 0 (0.0) | 7 (20.6) |
| Infiltrate 5 | 5.0 | 2 (3.6) | 3 (8.8) | |
| Normal Chest 10 | 10.0 | 0 (0.0) | 0 (0.0) | |
| **Total** | **100** | **100.0** | **56 (62.2)** | **34 (37.8)** |

## DISCUSSIONS

Mycobacterium tuberculosis is an important airborne infection and result in primary tuberculosis usually in children and reactivation of the quiet primary focus. The outcome of this study revealed varying pulmonaryfinding in immunocompetent adults in Abuja. The findings rangefrom fibrotic lesion to pleura effusion. Chest radiogram will not only corroborate the fact that the patients had pulmonary tuberculosis but also help to detect life threaten changes in the lungs. No mortality was recorded among the subjects investigated. There was male preponderance in this study and was in agreement with other study in the country(13,15)and around the world(8,12)but this was however contrary to previous study by Ballah(6) and Nasiru(11) in northeast Nigeria and Nwonwu in southeast Nigeria(10). This differences may be due to methodology employed in patient selection and for the fact that most of the study compared with this study were on HIV patients unlike our study where immunocompetent patients were prime subjects.

The predominant chest finding was lung fibrosis with 45%. This was not in agreement with studies in the country (10,11,15)and around the world(3,8). Reactivation is typical feature of adult tuberculosis and this was well expressed in most of the studies but in the Korea study where features of primary tuberculosis were observed. The difference observed may be due to the research subjects.Fibrosis a sequelae of pulmonary tuberculosis was profusely observed in this study due to late presentation of the patients to the center. Lack of awareness, ignorance and povertymay be responsible for the late presentation.In this study reactivation of primary focus andsequelaeobserved was not related to immunosuppression (HIV) becausethe entirepatients in this study were screened and those found positive were excluded. Cavitation was a predominant finding among patients with human immunodeficiency syndrome (HIV). Cavity formation is the final outcome in the process of granuloma formation, and occurs in the presence of intact specific delayed type of hypersensitivity; therefore cavity walls are lined by tuberculous granulation tissue and traversed by fibrotic remnants of bronchi and vessels.In this study, cavitation was observed in the same proportion with consolidation and lung collapse.

Upper zone predominant observed in this study was similar to studies in the Korea(8), although the sample size in the Korean study was smaller than the sample size in this study. All the cavitation lesions were entirely observed in the upper zone and all the pleura effusion were located in the lower zone. Unlike other studies(8,10,11,13) the lesions observed in this study were unilateral withexception of consolidation. Lesions were considered to be in the upper lung zone if cephalad to the pulmonary hila and in the lower lung zone if caudad to the hila(8).

## Conclusion

Pulmonary tuberculosis is still very much with us, although emphasis are placed more on immunocompromise patients, evaluation of radiology features in immunocompetent individual is encouraged. Fibrosis on chest radiogram is an essential squelae in pulmonary tuberculosis.

## Limitation of the study

Patients were not screened for other immunological disorders.

Simple tomography and computed tomography was not used in the study.

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