

Full Length Research Paper

Spectrum of Radiographic Features of Pulmonary Tuberculosis in University of Uyo Teaching Hospital, Uyo, Nigeria

Eduwem DU¹, Uduma FU¹, Eyo C², Ekott JU³, Opara DC⁴, Peters E³

¹Department of Radiology, Faculty of Clinical Sciences, College of Health Sciences, University of Uyo, Uyo, Nigeria.

²Department of Anesthesiology Faculty of Clinical Sciences, College of Health Sciences, University of Uyo, Uyo, Nigeria.

³Pneumology Unit, Department Of Medicine, Faculty of Clinical Sciences, College of Health Sciences, University of Uyo, Uyo, Nigeria

⁴Department of Community Medicine, Faculty of Clinical Sciences, College of Health Sciences, University of Uyo, Uyo, Nigeria

Accepted 18 April, 2015

Pulmonary tuberculosis (PTB) is a chronic bacterial infection caused by *Mycobacterium tuberculosis* (MTB). It is an airborne disease that is a major contributor to the disease burden in developing countries. To evaluate the radiographic features of pulmonary tuberculosis in University of Uyo teaching hospital (UUTH), Uyo, Nigeria. All patients who presented at Radiology Department of UUTH with positive chest radiographic features of PTB and have had a positive smear(s) from sputum samples performed with Ziehl-Neelsen staining method were included in this study. The duration of study was January, 2013 to November, 2014. Chest radiographs were taken in the posterior to anterior view using standard protocol. Chest radiographs were analyzed for radiographic diagnostic features of PTB. Only radiographs with positive features of PTB were considered. Excluded in this study were Ziehl-Neelsen smear negatives, Results were analyzed using SPSS window 13. A total of 168 patients were studied with 106 males (63.10%) and 62 (36.90%) females giving a male to female ratio of 1.71:1. Most of the patients (n=46, 27.38%) were within age range of 40-49. The commonest lung affected was left lung seen in 70 (41.67%), patients. Upper lung zonal localization was most predominant (n=76, 45.24%). The least localization site was in the lower lobe with (n= 20, 16.67% patients). Multiplicity of lesions in a single patient accounted for the 324 lesions seen in 168 patients. The commonest lesion was cavitory lesion seen in 48 patients (28.57%), followed by consolidative changes seen in 44 (26.19%) patients. The least lesion in terms of number were pneumothorax and shaggy heart seen in 4 patients each (2.38%). The commonest radiographic features of pulmonary tuberculosis in Uyo, Nigeria are lung cavity and lung consolidation. This is at variance with some previous studies that observed reticulo-nodular and reticular lesions.

Keywords: - Pulmonary tuberculosis, *Mycobacterium tuberculosis*, Radiographic features.

INTRODUCTION

Pulmonary tuberculosis (PTB) is a chronic bacterial infection caused by *Mycobacterium tuberculosis* (MTB). Other organisms such as *Mycobacterium bovis*, *Mycobacterium intracellulare*, *Mycobacterium kansasii* and *Mycobacterium avium* have also been implicated

(Nwonwu et al., 2008; Sultan and Al-Jebouri, 2010; Shitrit et al., 2007; De Backer et al., 2006; Maliwan and Zvetina, 2005). These other opportunistic organisms are commonly seen in individuals who have compromised body immunity. This obtains in people with uncontrolled diabetes, human immuno-deficiency virus (HIV) infection, chronic renal failure, chronic obstructive pulmonary disease, liver cirrhosis, cancers like leukemia and lymphoma (Nwonwu et al., 2008; Shin et al., 2012).

*Corresponding Author E-mail: felixuduma@yahoo.com

PTB is an airborne disease with route of transmission being inhalational. The risk factors are multifarious and include overcrowded prisons, homelessness, and poor living conditions, growing elderly population, alcohol / drug abuse, health care workers and poor nutritional status (De Backer et al., 2006).

Tuberculosis has become a major health problem in the world (Shin et al., 2012). It has remained endemic and became a major contributor to the disease burden in developing countries (Nwonwu et al., 2008; De Backer et al., 2006).

Diagnosis of PTB can be made from clinical features. But 20% of PTB patients are completely asymptomatic (especially sputum smear-negatives) (Shin et al., 2012). Therefore other methods of diagnosis of PTB must be sought. These range from Acid-fast bacilli (AFB) sputum smears, chest radiography, isolation of MTB in cultures, tuberculin skin test (TST) or Mantoux test, high resolution computed tomography (HRCT) to fiberoptic bronchoscopy. Though all these methods have their peculiar usefulness but they are also fraught with limitations. Sputum AFB smears have poor sensitivity (30–70%) despite high specificity (98–99%) but fewer than half of these patients have a positive sputum smear (Shin et al., 2012). Mycobacterial cultures are more sensitive than AFB smears (80–85%) and more diagnostic but isolation of MTB takes as much as 3-8 weeks (Shin et al., 2012). The alternative method that assists in the diagnosis of sputum smear-negative PTB and latent TB infection is TST or Mantoux test but is limited by cross-reactivity with non-tuberculous mycobacterial species and Bacillus Calmette-Gueurin (BCG) vaccine strains (Shin et al., 2012). Mantoux test sensitivity is further influenced by malnutrition and immunity depression. Fiberoptic bronchoscopy is an invasive and expensive procedure despite its usefulness in endobronchial TB diagnosis, failed sputum expectoration, sputum smear-negative PTB and providing alternative respiratory specimens for diagnosis (Shin et al., 2012).

Based on the foregoing, a cheap and readily available diagnostic tool like chest radiography should be exploited. More so since TB is commonly a disease of developing nations with scarce resources. Noteworthy too is that radiological features are now incorporated in the diagnostic criteria of PTB in WHO program. (Sultan and Al-Jebouri, 2010) In current WHO program for PTB, symptoms suggestive of PTB correlated with radiographic abnormalities consistent with active PTB are regarded as suggestive of PTB even in negative AFB sputum smear (Nwonwu et al., 2008). Therefore, chest radiography plays an important role in the screening, diagnosis, management and follow-up of tuberculosis (Nwonwu et al., 2008; Shin et al., 2012; Eini et al., 2013).

AIM

To evaluate the radiographic features of pulmonary tuberculosis in University of Uyo teaching hospital, Uyo,

South-South geo-political zone of Nigeria.

We also aim to contribute to medical information that would positively influence TB control programs, in Uyo, Nigeria.

MATERIALS AND METHODS

The site of study is University of Uyo teaching hospital (UUTH), Uyo, South South geopolitical zone of Nigeria. It is a tertiary care hospital that attends to the health needs of Uyo, Akwa Ibom state, Nigeria as well as other cities of the state and neighboring states.

All patients who presented with positive chest radiographic features of pulmonary tuberculosis and have had a positive smear from sputum samples performed with Ziehl-Neelsen staining method were included in this study. The duration under study was January, 2013 to November, 2014. Demographic data and clinical features were collected. Chest radiographs were taken in the posterior to anterior view using the standard protocol. Chest radiographs were analyzed by a minimum of two radiologists for radiographic diagnostic features of PTB. Only radiographs with positive features of PTB were considered. Excluded in this study were Ziehl-Neelsen smear negatives, patients with extra-pulmonary tuberculosis, poor or un-diagnostic radiographs. Immune status of enrollee and previous treatment regimen were not considered in this study. Results were analyzed using SPSS window 13.

RESULTS

A total of 168 patients were studied under the studied period with 106 (63.10%) males and 62 (36.90%) females giving a male to female ratio of 1.71:1. Most of the patients (n=46, 27.38%) were within age range of 40-49, followed by 20-29 with 34(20.24%) patients. The least were seen in the extremes of age (see table 1).

Of these 168 patients, those with left lung lesions were 70 (41.67%), patients with right lung lesions were 40 (23.81%) while patients with bilateral lung lesions were 58 (34.52%). Patients with upper lung zonal lesions were predominant. They were 76 (45.24%) in number. This is followed by middle zonal lesions, seen in 24 (20%) patients. The least localization site was in the lower zone with 20 (16.67%) patients. Multi-zonal lesions were seen in 16 patients. Uncharacterized lesions in terms of locations were seen in 32 (19.05%) patients.

Some of these 168 patients had more than one radiographic feature in each case and therefore the total number of lesions reported was 324. The commonest lesion was cavitory lesion seen in 48 (28.57%) patients, followed by consolidative changes seen in 44 (26.19%) patients. Others were reticulonodular lesions seen in 32 (19.05%) patients and reticular lesions in 24 (14.28%) patients. The least lesion in terms of number was pneumothorax and shaggy heart seen in 4 (2.38%) patients each. All these lesions were predominant in

Table 1. Showing studied population

AGE RANGE	MALES	FEMALES	TOTAL
0-9	6	4	10
10-19	6	2	8
20-29	16	18	34
30-39	20	8	28
40-49	28	18	46
50-59	10	8	18
60-69	18	4	22
70-79	2	0	2
80-89	0	0	0
90-99	0	0	0
TOTAL	106	62	168

Table 2. Showing lung radiographic features

RADIOG LESIONS	MALES	FEMALES	TOTAL
PUL. CAVITY	36	12	48 (28.57%)
HORIZ. FISSURE	4	4	8 (4.76%)
PLEURAL EFF	4	4	8 (4.76%)
LAMELLAR EFF	0	0	0 (0.00%)
RETICULO-NOD	24	8	32 (19.04%)
NODULAR	16	4	20 (11.90%)
RETICULAR	12	12	24 (14.28%)
PNEUMOTHORAX	4	0	4 (2.38%)
DESTROYED LUNG	20	8	28 (16.67%)
MILIARY	8	6	14 (8.33%)
PUL. CALCIF.	8	0	8 (4.76%)
VOLUME LOSS	4	4	8 (4.76%)
MEDIAST. SHIFT	20	4	24 (14.28%)
CYSTIC	8	12	20 (11.90%)
BULLA	4	4	8 (4.76%)
CONSOLIDATIONS	36	8	44 (26.90%)
DISSEMINATED	0	0	0 (0.00%)
SHAGGY HEART	4	0	4 (2.38%)
ATELECTASIS	4	4	8 (4.76%)
HONEY COMB	8	0	8 (4.75%)
HILARY NODE	12	4	16 (9.52%)
TOTAL	236	98	334

(Table 2 acronyms: RADIO-Radiographic, PUL-Pulmonary, HORIZ-Horizontal, EFF-Effusions, RETICULO-NOD-Reticulo-nodular, CALCIFIC-Calcification, MEDIAST-Mediastinal)

males except in cystic lung changes. (See table 2).

DISCUSSION

It is worrisome that the majority of the first tenth commonest radiographic features of pulmonary tuberculosis (PTB) in Uyo, Nigeria smack sinister. They either suggest PTB activity, infectiousness, and immunodeficiency or PTB progression. In order of decreasing frequency of occurrence, there are pulmonary cavities (28.57%), lung consolidation (26.90%), reticulonodular lesions (19.04%), destroyed lung syndrome (16.67%), reticular lesions (14.28%),

mediastinal shifts(14.28%), nodular (11.90%), cystic (11.90%) pulmonary hilar node (9.52%) and miliary shadows (8.33%). This finding is contrary to another study where the commonest lesions are reticulonodular lesion and reticular lesions which are features of post-primary PTB (Anghong et al., 2011).

As noted above, our commonest finding was pulmonary cavity. Pulmonary cavity in PTB in many respects, only impute active disease with high infectivity. This implies greater social risk as both relations and care givers are susceptible (Nwonwu et al., 2008). Similarly, consolidative changes or lung parenchymal disease in PTB is one of the five integral changes typical of primary PTB (De Backer et al., 2006; Jin et al., 2008). This is

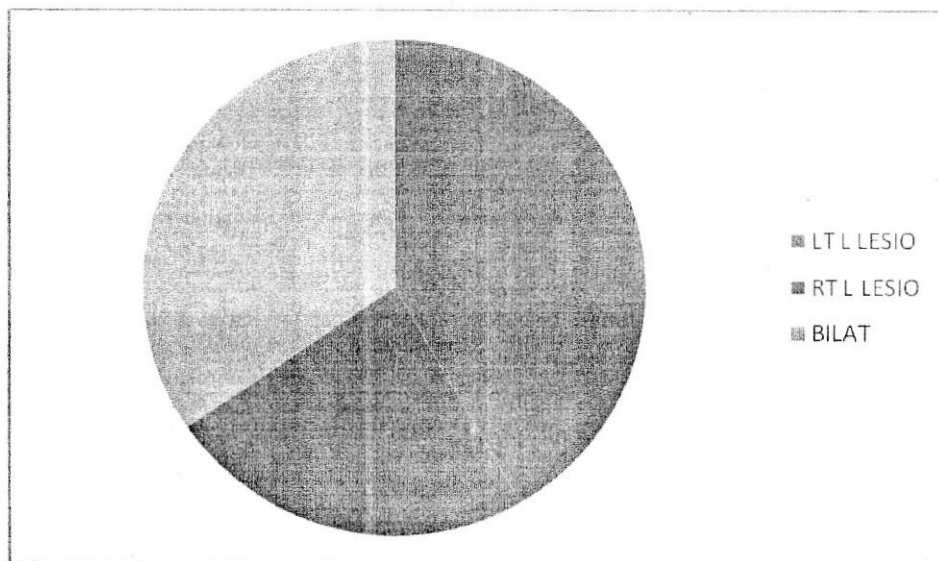


Figure 1. Pie-Chart Showing Lung Localizations of PTB

(FIGURE 1 acronyms- LT L LESIO-Left lung lesions, RT L LESIO-Right lung lesions, BILAT.-Bilateral lung lesions)

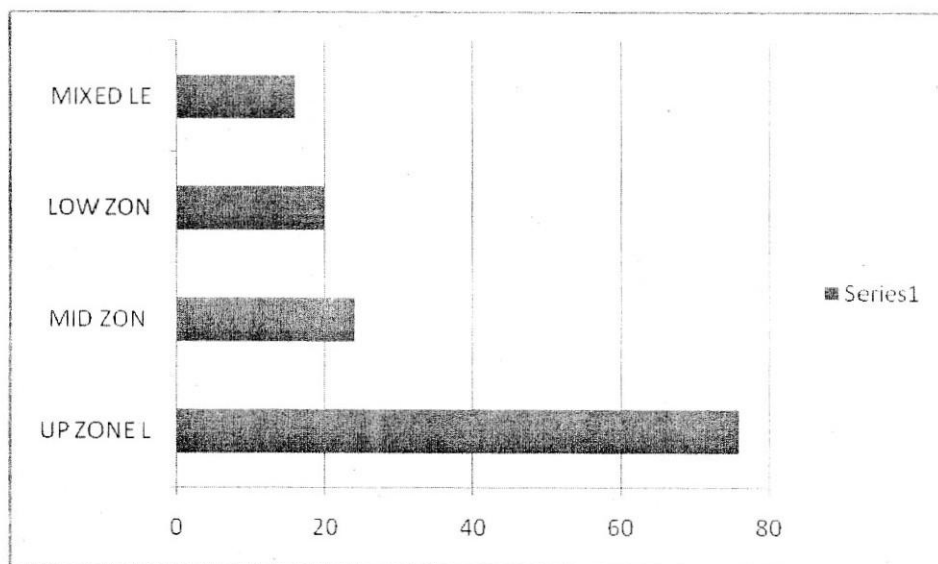


Figure 2. Bar Chart Showing Lung Zonal Localizations of PTB

(FIGURE 2 acronyms-MIXED LE-Mixed lung lesions, LOW ZON-Lower lung zonal lesions, MID ZON-Mid-zonal lung lesion, UP ZONE L-Upper zonal lung lesions)

usually seen in extremes of age or people with low immune status (De Backer et al., 2006; Jin et al., 2008). This is also not healthy for our local environ as by extension it may probably suggest a co-existing immunosuppressive conditions in these patients. These conditions include human immunodeficiency virus (HIV), acquired immunodeficiency disease (AIDS), diabetes mellitus and malignancies (Jin et al., 2008). However our study was outside the scope of HIV-PTB co-infections.

One of the least recognized features in this study was

pulmonary calcification (4.76%). This is also of major concern as one would have expected a high frequency. This is because of the vigorous programs mounted by our government and international community to ensure free and wide distribution of anti-tuberculosis drugs. Pulmonary calcification is one index that may suggest healed old PTB. The dearth of such features in our study may suggest improper treatment, drug non-compliance or presence of multi-drug resistant PTB (MDRPTB). The later is a dangerous evolving scenario (De Backer et al.,

2006). MDRTB is defined as TB that is resistant at least to isoniazid and rifampicin; the two most powerful first-line anti-TB drugs (Sultan and Al-Jebouri, 2010).

The chest radiographic findings suggestive of PTB are widely known and heterogeneous (Nwonwu et al., 2008; Woodring et al., 1986; Lawn et al., 2014). In terms of single entity modal frequency, our study however still kept to the traditional commonest finding of pulmonary cavity in PTB among Nigerians (Nwonwu et al., 2008; Sultan and Al-Jebouri, 2010). These cavities were more often bilateral like the opacities, which suggested that more than one lobe was involved in most of the cases. This agreed with another report (Nwonwu et al., 2008).

In terms of sex distribution, our study is in keeping with other studies with male predominance (Nwonwu et al., 2008; Sultan and Al-Jebouri, 2010; Uneke and Alo, 2006). PTB is transmitted by airborne droplet nuclei from infected persons (Sultan and Al-Jebouri, 2010; De Backer et al., 2006). Males are more ambulant and therefore more exposed. As mentioned previously, overcrowding is a risk factor; one would have imagined females to be more at risk as they naturally care for the sick at home alongside with caring for other members of the probably over-populated family in our local setting. This study however is unintentionally limited by sex bias from patient recruitment (See table 1). The commonest age affected by PTB in Uyo in this study was 20-49 year age range. PTB is known to be most common among people in their productive years with huge economic impact (Sultan and Al-Jebouri, 2010; De Backer et al., 2006). For instance, in 2006, TB caused India to lose an estimated 23.7 billion United States dollars (Sultan and Al-Jebouri, 2010).

The regional lung topography in our study is similar to other studies as the left lobe is more affected than the right lobe in the ratio of 1.75:1 (see figure 1) (Nwonwu et al., 2008; Eini et al., 2013). But another study showed more frequent involvement of the right lobe especially pulmonary cavities (Nwonwu et al., 2008). But bilateral lung disease of PTB is also common as seen in another study (Shitrit et al., 2007). Similarly, upper lobe is most frequently affected than others in this study (See figure 2). The upper lobe high involvement is not surprising as the modal frequency lesion in this study is lung cavity which also has upper lung lobe predilection. The cavity arose from lung parenchymal necrosis, a sequel of lung hypo-ventilation. Certain reasons have been adduced and this includes difference in lung ventilation. The least affected lobe is the lower lobe of the lungs. The primary focus of primary PTB is in the highly ventilated apico-basal pulmonary segment of lower lobe, middle lobe and anterior broncho-pulmonary segments of upper lobe as MTB is an aerobe[4,10]. The site of predominance changes to apical, posterior and apico-posterior broncho-pulmonary segments of upper lobes in post-primary PTB.

The significance of this study is adding our local data to PTB epidemiology. Surprisingly, this has brought to the fore an urgent and intensified need of local PTB combat. This is more so, as the most frequent lesions are at variance with other studies and the clinical implications of such PTB radiographic features are not good indices for

our local environ.

However, this study is limited by its inadvertent sex bias introduction and single institution study. Incorporation of more centers would have provided wider scope of PTB scourge in Uyo. Other limitations in this study may be high false positive and high false negatives rates. False negative rate will arise from normal chest findings or atypical chest findings in PTB cases especially in sputum smear negatives (Shin et al., 2012). A previous study indicated that about 25% of radiologically stable PTB lesions could still have active disease (Nwonwu et al., 2008). High false positive rates may result from positive chest findings in a previously treated PTB infection (Shin et al., 2012). Similarly, the time of presentation of patients to radiology department and the presence of other pulmonary conditions (such as occupational lung diseases, sarcoidosis, and chronic obstructive airway disease) could influence radiographic findings in patients with pulmonary tuberculosis (Nwonwu et al., 2008).

CONCLUSION

The commonest radiographic features of pulmonary tuberculosis in Uyo, Nigeria are lung cavity and lung consolidation. This is at variance with some previous studies that observed reticulo-nodular and reticular lesions.

In our local environ, pulmonary tuberculosis is more predominant in males and middle age with preference for left lung and upper lobes. Multiplicities of lesions are commoner than single lesion.

RECOMMENDATIONS

More governmental interventions are paramount as these commonest lesions in Uyo suggest infectivity and immunodeficiency, unwelcome local developments.

IMPLICATIONS: The study helps the clinical pulmonologists to be on the lookout for chest radiographic features that may suggest pulmonary tuberculosis.

DISCLOSURE: No Financial Disclosure Information.

REFERENCES

- Angthong W, Angthong C, Varavithya V (2011). Pretreatment and posttreatment radiography in patients with pulmonary tuberculosis with and without human immunodeficiency virus infection. *Ja J Radiol*, 29 (8): 554-562
- De Backer AI, Mortelé KJ, De Keulenaer BL, Parizel PM (2006). Tuberculosis: Epidemiology, Manifestations, and the value of medical imaging in diagnosis *JBR-BTR*, 89: 243-250 doi:10.1186/1471-2334-12-141.
- Eini P, Osquee HO, Rahighi A H (2013). Chest radiological features

- among patients with smear positive pulmonary tuberculosis. *Caspian J Internal Med*; 4 (4): 777-780
- Jin S, Lee HJ, Park E, Lee HY, Lee S, Yang S, Yoo C (2008). Frequency and predictors of miliary tuberculosis in patients with miliary pulmonary nodules in South Korea: A retrospective cohort study *BMC Infectious Diseases*, 8: 160 doi:10.1186/1471-2334-8-160
- Lawn SD, Evans AJ, Sedgwick PM, Acheampong JW (2014). Pulmonary tuberculosis: radiological features in west Africans coinfecting with HIV. *The British J Radiol*; 72 (856) Doi: <http://dx.doi.org/10.1259/bjr.72.856.10474493>
- Maliwan N, Zvetina JR (2005). Clinical features and follow up of 302 patients with *Mycobacterium kansasii* pulmonary infection: a 50 year experience. *Postgrad Med*; 81: 530-3.
- Nwonwu EU, Oyibo PG, Imo AOC, Ndukwe CD, Obionu CN, Uneke CJ (2008). Radiological features of pulmonary tuberculosis in HIV positive and HIV-negative adult patients in south-eastern Nigeria. *Mera: Afr J Respir Med*, March, 20-23
- http://indexmedicus.afro.who.int/iah/fulltext/ajrm/mar08/ajrm-20-23.pdf?origin=publication_detail
- Shin JA, Soo- Chang Y, Kim TH, Kim HJ, Aha CM, Byun MK (2012). Fibroptic bronchoscopy for the rapid diagnosis of smear negative pulmonary tuberculosis. *BMC Infectious diseases*, 12: 141.
- Shitrit D, Priess R, Fox B, Amital A, Kramer M R (2007). Pulmonary *mycobacterium kansasii* infection: Comparison of the clinical features, radiological appearance and outcome with pulmonary tuberculosis. *Chest*; 132(4) Meeting abstract:434 Doi:10.1378/chest.132.4_Meeting Abstracts:434
- Sultan HI, Al-Jebouri MM (2010). Pulmonary tuberculosis in Alzab district Tikrit. *Med*;16 (1): 37-41
- Uneke CJ, Alo MN (2006). Rising cases of smear-positive pulmonary tuberculosis in south-eastern Nigeria: the public health implication. *Afr J Respir Med*; 1: 11-14.
- Woodring JH, Vandiviere HM, Fried AM, Dillon ML, Williams TD, Melvin IG (1986). Update: the radiographic features of pulmonary tuberculosis. *Am J Roentgenol*, 146 (3): 497-506.