Original Contribution

Clinical and Radiological Presentation of Patients with Smear Positive Pulmonary Tuberculosis

***Noor SM[1], Ahmad MM[2], Anwar KMR[3], Chowdhury MF[4], Sultana M[5], Kader MA[6], Khan MAS[7]**

Chest X-ray is an important diagnostic aid frequently used alongside microscopic smear of sputum for the confirmation of pulmonary tuberculosis (TB). However, there is a dearth of literature investigating the clinical and radiological pattern of sputum positive pulmonary TB among adults in Bangladesh. The current study explored these patterns in presentation. This descriptive cross-sectional study was conducted at outpatients in department of medicine of a tertiary care hospital. A total of 50 newly diagnosed adult cases of smear positive pulmonary TB attending at the Directly Observed Treatment Short-course (DOTS) corners were consecutively included. Informed written consent was taken before inclusion. Data were collected through face-to-face interview. Radiological presentation was explored using chest X-ray. Data were analyzed by SPSS version 26.0. The average age of patients was 41.0±17.12 years and majority were male (78.0%). The most prevalent respiratory symptom was cough (80.0%) followed by constitutional symptom like fever (70.0%) and weight loss (72.0%). Wasting was the predominant sign (60.0%). Radiologically both lungs were involved in 32.0%, left lung were involved in 30.0% cases and right lung were involved in 26.0% of cases. Twelve percent (12.0%) of patients had normal chest X-ray. Upper zone involvement was commonly observed in this study's patients (66.0%). The predominant pattern was consolidation (46.0%) followed by fibrosis (26.0%), nodular opacity (12.0%), collapse (10.0%), cavity (6.0%), pleural effusion (2.0%) and bronchiectasis (2.0%). Findings of this study would help familiarize and identify the common clinical and radiological presentations of sputum positive pulmonary TB patients in day-to-day practice.

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Key words: Pulmonary TB, Radiologic pattern, Clinical pattern, Sputum smear positive

Introduction

Tuberculosis (TB) is a major public health problem worldwide with an estimated annual incidence of 10 million cases and 1.3 million deaths in 2019[1]. Most of the TB cases occurred in South-East Asia (44.0%), Africa (25.0%) and the Western Pacific (18.0%) with small proportion from other regions[1]. If the current trends continue, a total of 62 million excess cases are projected to occur in 29 high burden countries by 2035[2]. Bangladesh has remained one of the 30 high TB burden countries in the world. It has the seventh highest rate of tuberculosis (TB) with a prevalence of 221 cases per 100,000 populations according to a report published by World Health Organization (WHO) in 2020[1]. *Mycobacterium tuberculosis*, the causative agent of TB, is transmitted from a person to person by respiratory droplets[3]. It and primarily causes are respiratory infection. Hence, pulmonary TB is mainly diagnosed through sputum tests. Sputum culture is the gold standard of detecting TB in lungs. However, due its unavailability in many centers, TB is mainly detected through microscopy of sputum in most centers which is a low-cost but less sensitive alternative to culture.

1. **Dr Sayeda Mubina Noor, Consultant, Department of Endocrinology, Ibn Sina Diagnostic and Imaging centre, 9/A Dhanmondi, Dhaka, Bangladesh; E-mail: sayedamubina_33@yahoo.com*
2. *Dr Md Mohiuddin Ahmad, Professor of Respiratory Medicine, Dhaka Medical College and Hospital, Dhaka, Bangladesh*
3. *Dr Kazi Md Rubayet Anwar, Assistant registrar, Department of Cardiology, National Institute of Cardiovascular Diseases (NICVD), Dhaka*
4. *Dr Mohammad Fahad Chowdhury, 388/3596 North Badda, Shadhinota Soroni, Gulshan, Dhaka, Bangladesh*
5. *Dr Maimuna Sultana, Junior Consultant (Medicine), Kurmitola General Hospital, Dhaka*
6. *Md Abdul Kader, Research Associate, Pi Research & Development Center, Dhaka*
7. *Dr Md Abdullah Saeed Khan, Director, Pi Research and Development Center, Dhaka, Bangladesh*

**for correspondence*

To increase the sensitivity of yield, International Standards for Tuberculosis Care categorically recommended that all patients (adults, adolescents, and children who are capable of producing sputum) suspected of having pulmonary tuberculosis should have at least two, and preferably three, sputum specimens obtained for microscopic examination[4]. Nonetheless, chest X-ray has been a part of TB diagnosis for over a century[5]. Chest X-ray not only aid in the diagnosis of TB but also provides a guide to distinguish primary and post primary tuberculosis due to its various presentation and site predilection[6]. The initial suspicion of pulmonary TB is often based on an abnormal chest radiograph in a patient with respiratory symptoms. Although the 'classic' picture is that of upper lobar disease with infiltrate and cavities, virtually any radiographic pattern-from a normal film or a solitary pulmonary nodule to bilateral diffuse reticulonodular shadowing may occur pulmonary TB[6]. However, limited data is available in the context of Bangladesh regarding patterns of presentation and site predilection in chest X-ray of such patients. Therefore, the objective of the study aimed to describe the pattern of chest X-ray in a series of smear positive pulmonary TB patients in a tertiary care hospital of Bangladesh.

Methods

This was a descriptive cross-sectional study conducted in the outpatient department of medicine, Dhaka Medical College Hospital, Dhaka, Bangladesh over the duration of six months extending from June 2016 to November 2016. Newly diagnosed cases of smear positive pulmonary TB attending in the Directly Observed Treatment Short-course (DOTS) corners and aged >18 years were approached for inclusion. A total of 50 patients consenting for inclusion were consecutively selected. Patients having COPD, interstitial lung disease, pregnancy were excluded.

Measures

Data collection was done through face-to-face interview using a structured questionnaire. The questionnaire consisted of three parts- socio-demographic parameters, clinical characteristics, and chest X-ray findings of patients. Patients with evidence of at least one or more initials sputum smears positive for acid fast bacilli (AFB) was considered as smear positive pulmonary tuberculosis[7,8]. Chest X-ray was done using the digital X-ray equipment (Multix Fusion Max, Siemens, Healthineers, USA). Both posteroanterior view and left or right lateral view where appropriate were obtained. All the X-ray films were reviewed by an expert radiologist.

Ethical measures

The study protocol was approved the ethical review committee (ERC) of Dhaka Medical College Hospital (No.: 111) before the commencement of the study. All the procedures were conducted following the guideline of Declarations of Helsinki and its subsequent amendments. Informed written consent was taken from the participants before inclusion.

Statistical analysis

Data were checked and entered into SPSS version 26.0 for analysis. Categorical variables were expressed as frequency (percentage) and continuous variables were expressed as the mean (standard deviation). Pie and column charts wherever appropriate, were need to present data.

Results

The mean age of 50 patients included in this study was 41.0±17.12 years and majority of them were male (78.0%). The most common occupation was business (22.0%) followed by job holder (20.0%). Majority had their monthly income <20000 BDT (60.0%) shown in Table I.

The most prevalent symptoms were productive cough (80.0%), followed by weight loss (72.0%), fever (70.0%), loss of appetite (70.0%), malaise (64.0%), night sweats (54.0%), hemoptysis (40.0%), shortness of breath (15.0%) and chest pain (26.0%). The most common general sign was generalized wasting (60.0%). Examination of respiratory system revealed increased respiratory (tachypnea) rate (>20 breaths/min) in 20.0%, asymmetrical chest movement in 30.0%, tracheal/mediastinal shifting in 10%, increased vocal fremitus in 30.0%, dull percussion notes in 60.0%, breath sound bronchial in 40% and diminished in 10.0%, crepitations in 20.0%, ronchi in 10.0% and increased vocal resonances in 40.0% (Table II).

Table I: Socio-demographic characteristics of patients (n=50)

Characteristics	n (%)
Age (years)	41.00±17.12
Age groups	
16-25	10 (20.0)
26-35	11 (22.0)
36-45	13 (26.0)
46-55	06 (12.0)
56-65	04 (08.0)
66-75	03 (06.0)
76-86	03 (06.0)
Sex	
Male	39 (78.0)
Female	11 (22.0)
Occupation	
Business	11 (22.0)
Job holder	10 (20.0)
Student	05 (10.0)
House wife	05 (10.0)
Hawker	04 (08.0)
Day laborer	03 (06.0)
Rickshaw-puller	02 (04.0)
Van driver	02 (04.0)
Cobbler	02 (04.0)
Welder	01 (02.0)
Fisherman	01 (02.0)
Retired and others	04 (08.0)
Monthly family income (BDT)	
<20000	30 (60.0)
20000-40000	15 (30.0)
>40000	05 (10.0)

Table II: Clinical presentation of patients (n=50)

Characteristics		n(%)
Symptoms		
Productive cough		40 (80.0)
Weight loss		36 (72.0)
Fever		35 (70.0)
Loss of appetite		35 (70.0)
Malaise		32 (64.0)
Night sweats		27 (54.0)
Hemoptysis		20 (40.0)
Shortness of breath		15 (30.0)
Chest pain		13 (26.0)
Signs		
General		
Wasting		30 (60.0)
Anemia		07 (14.0)
Lymphadenopathy		05 (10.0)
Clubbing		04 (8.0)
Respiratory system		
Respiratory rate (breaths/min)	>20	10 (20.0)
	<20	40 (80.0)
Chest movement	Symmetrical	35 (70.0)
	Asymmetrical	15 (30.0)
Tracheal/mediastinal shifting	Central	45 (90.0)
	Shifted	05 (10.0)
Vocal fremitus	Normal	30 (60.0)
	Increased	15 (30.0)
	Decreased	5 (10.0)
Percussion note	Resonant	20 (40.0)
	Hyper resonant	00 (00.0)
	Dull	30 (60.0)
Breath sound	Vesicular	25 (50.0)
	Bronchial	20 (40.0)
	Diminished	05 (10.0)
Added sound	Absent	35 (70.0)
	Crepitations	10 (20.0)
	Pleural Rub	00 (00.0)
	Ronchi	05 (10.0)
Vocal resonance	Normal	25 (50.0)
	Increased	20 (40.0)
	Decreased	05 (10.0)

In chest X-ray of the patients 32.0% had both lung involvements, 30.0% had left lung involvement, 26.0% had right lung involvement, and 12.0% did not have any visible chest X-ray findings (Figure 1).

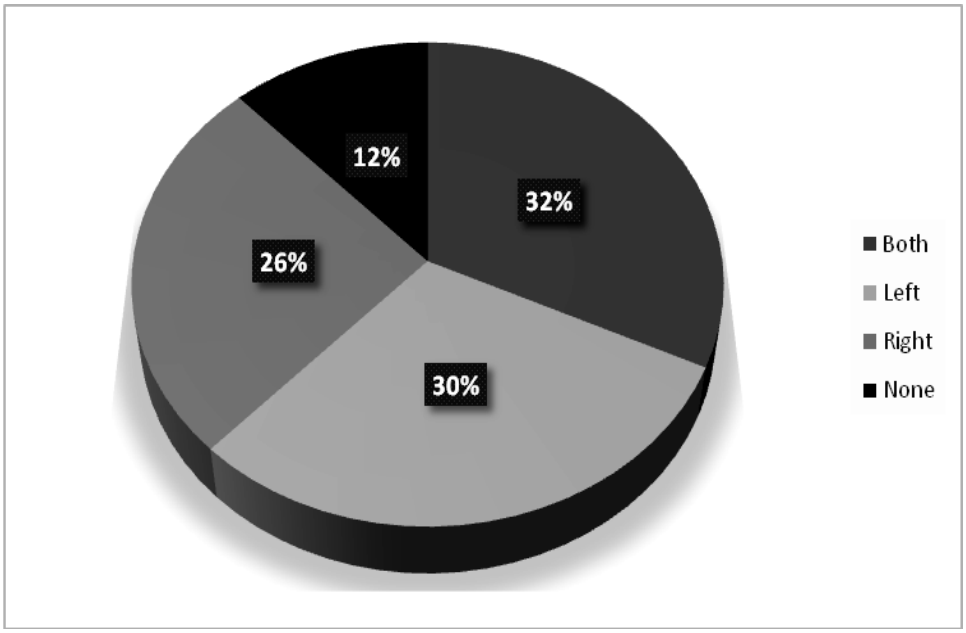

Figure 1: Distribution of patients according to affected lung in chest X-ray (n=50)

In majority cases both upper and middle zone of lung was involved 38.0% (19) cases, followed by only upper zone involvement in 28.0%, lower zone involvement in 18.0%, middle zone involvement in 2.0% and all zone involvement in 2.0% (Figure 2).

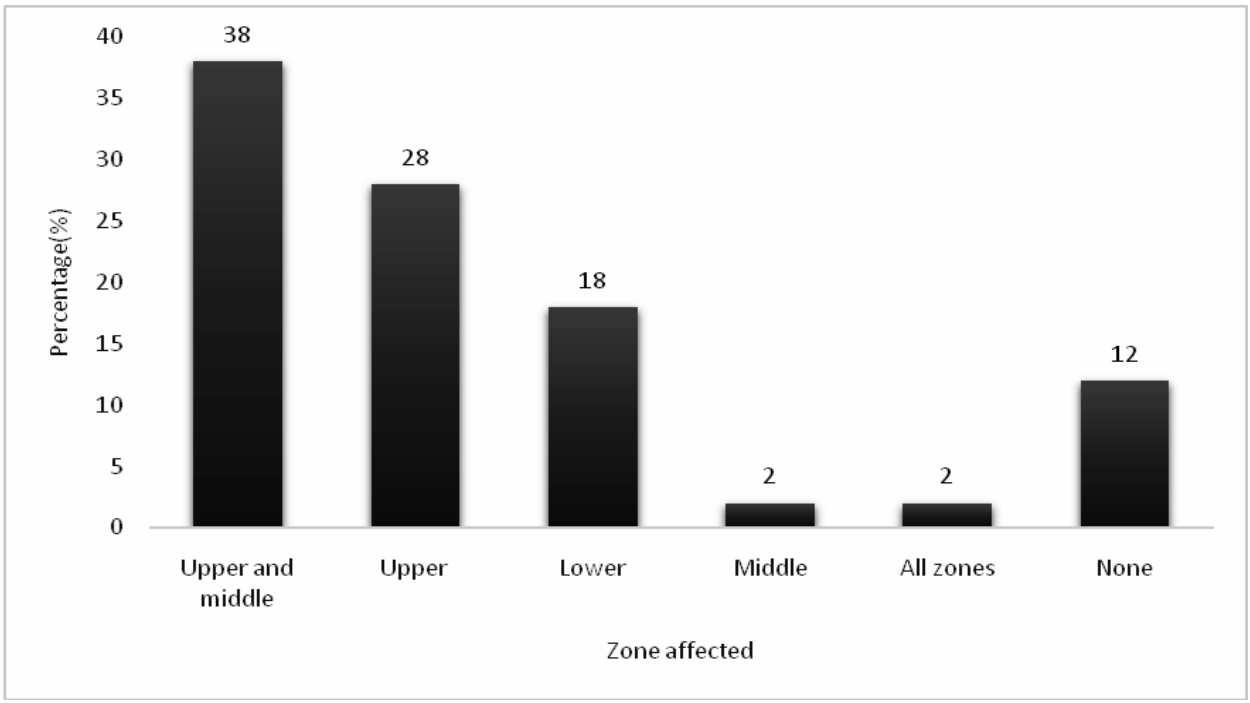

Figure 2: Distribution of patients according to affected zone of lung in chest X-ray (n=50)

Table III: Pattern of lung involvement in chest X-ray of patients (n=50)

Findings*	n (%)
Fibrosis	13 (26.0)
Inhomogeneous opacity	13 (26.0)
Patchy opacity	07 (14.0)
Nodular opacity	06 (12.0)
Collapse	05 (10.0)
Dense homogenous opacity with air bronchogram	03 (06.0)
Cavity	03 (06.0)
Bronchiectasis**	03 (06.0)
Pleural effusion	01 (02.0)
Normal	06 (12.0)
Combination of findings	
Fibrosis with collapse	04 (08.0)
Fibrosis with inhomogeneous opacities	02 (04.0)
Fibrosis with bronchiectasis	01 (02.0)
Patchy opacity with cavity	02 (04.0)
Nodular opacity with inhomogeneous opacity	01 (02.0)
Nodular opacity with collapse	01 (02.0)
Dense homogenous opacity with cavity	01 (02.0)

*The number represents multiple nonexclusive responses; **Characterized by tram track opacity and air-fluid level.

Chest X-ray finding was diverse and overlapping (Table III). Of all, 12 patients (24.0%) had more than one finding in their X-ray and 120% had normal shadows. Total 23 patients had chest X-ray markers of consolidation (46.0%). Among them, the most frequent finding was inhomogeneous opacity (26.0%), followed by patchy opacity (14.0%), and dense homogenous opacity with air bronchogram (6.0%). Other patterns included fibrosis (26.0%), nodular opacity (12.0%), collapse (10.0%), cavity (6.0%), pleural effusion (2.0%) and bronchiectasis (2.0%). Among 12 patients who had more than one finding in X-ray, fibrosis was mostly found with collapse (8.0%) followed by inhomogeneous opacity (4.0%) and bronchiectasis (2.0%). Four percent had patchy opacity along with cavity. Nodular opacity was accompanied by inhomogeneous opacity in 2.0% and collapses another 2.0%. One case of dense homogenous opacity had cavity as associated finding (2.0%).

Discussion

Although the standard diagnostic approach for pulmonary tuberculosis is isolation of *Mycobacterium tuberculosis* from respiratory secretions through microscopy of sputum sample, chest X-ray remains equally important in the diagnosis. However, patients do not always present with the classical chest X-ray features. Hence, an understanding of radiographic patterns of presentation is required for clinicians. Here, we aimed to describe the pattern of X-ray in a series of 50 smear positive pulmonary TB cases. Patients in this study were on average aged 41 years similar to that reported by Ozsahin et al.[9]. Notably a major bulk of patients was young adults and adults with 68% being aged ≤45 years. A previous case series published by Barman et al.[10] from a tertiary care hospital also described similar

findings (65.1% aged ≤50 years). This indicates that environmental factors like close habitation and gathering might be more important in contracting TB in Bangladesh. A predominance of male patients in our study also supports this assumption. A high prevalence of TB among male is, nevertheless, a global trend[1]. Because, in most countries; males are at high risk of contacts with potential spreaders due their movements for occupation. Various presentations of clinical symptoms were found in this study and most prevalent respiratory symptom was productive cough. It followed in frequency by constitutional features like weight loss, fever, loss of appetite, malaise and night sweats. Hemoptysis, shortness of breath and chest pain was found in less than 40.0% of patients. These features vary in frequency from study to study based on the participant characteristics. For example, children predominantly present with constitutional symptoms like fever and weight loss[11,12]. Similarly, constitutional and system specific signs vary based on the extent of involvement and other characteristics. However, the differences could be random. Either way patients usually present with a combination of respiratory and general features noted in our study[13]. However, productive cough and weight loss are frequently associated with culture positive TB compared to non-TB cases[14].

In this study, both lungs were affected in approximately one-third cases similar to that observed by Sant'Anna in Brazil[15]. Additionally, the typical upper lob predilection of TB was seen in 66.0% patients with 38.0% having simultaneous middle lobe involvement. Similar observation was reported among children by Karim et al.[11] in Bangladesh and Koh et al.[16] in Korea.

In the chest X-ray of our sputum positive TB patients, the most prevalent finding was consolidation (infiltrates) including in homogeneous opacity, patchy opacity and dense homogenous opacity with air bronchogram. Sant'Anna et al.[15] described a similar finding among adolescent with 53.3% patients having pulmonary infiltrated and 3.9% having cavitation. We found cavitation among 6.0% of patients but like them we didn't find any instances of miliary TB. However, presence of cavity seems to be more common in hospitalized pulmonary TB patients as Ozashin et al.[9] found 72.0% cases of cavitary lesion in a series of 800 hospitalized cases. Interestingly, we noted normal chest X-ray in 12.0% patients concordant to findings from a past study where 15.0% non-AIDS TB patients had normal roentgenogram[17]. However, it is very rare to find hospitalized cases without findings in chest X-ray film[9] Cohen et al.[14] found that one of the three typical features including nodular, alveolar, or interstitial infiltrates are significantly more common in smear positive TBs compared to smear negative ones. Hence, smear negative TB might pose a diagnostic difficulty where other clinical evidence have to add up for expert judgment. This study had several limitations. It was a single center study with a small sample size. A comparison between smear positive and negative cases and between HIV positive and negative cases was not possible. Additionally, the sequential changes in chest X-ray couldn't be explored. We recommend large multi-center studies with incorporation of various subgroups to explore the radiographic patterns on a finer detail.

Conclusion

Patients with pulmonary tuberculosis present with variable clinical and radiological features. It is difficult to establish any uniform and distinct pattern in radiology of smear positive patients. The limited number of cases studies here may not be completely representative of the diverse clinical and radiological presentation of smear positive pulmonary tuberculosis. However, it provided an idea about the presentation of pulmonary tuberculosis in chest X-ray in the context of our country, which could be helpful for familiarizing and identifying the common presentations in day-to-day practice.

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