PULMONARY SEQUELAE IN TUBERCULOSIS: ANALYSIS OF CLINICAL AND RADIOLOGICAL PATTERN IN 172 PATIENTS

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ABSTRACT

BACKGROUND

Tuberculosis is a disease of major public concern in developing countries like India. Approximately one third of world's population is estimated to be infected with Mycobacterium tuberculosis. Lungs are being the most common and often the first site to be infected with tuberculosis bacilli. Radiological imaging plays an important role both in the diagnosis as well as in identification of sequelae and complications arising out of Tuberculosis.

The aim of this study was to determine the imaging features of post tuberculosis sequelae and complications of thoracic tuberculosis affecting the lung parenchyma, airways, pleurae & mediastinum.

MATERIALS AND METHODS

It's a prospective and non-randomised study, conducted in 172 patients during the time period of November 2016 to August 2018 at a tertiary referral hospital located in coastal part of India.

RESULTS

Mean age of study population was 46.3 years with male:female ratio of 12:5. Among the study population, 37% of the patients had received ATT for the first time and 63% of patients had received more than once. The most common radiological findings were fibrosis (66%) and bronchiectasis (39%). Other parenchymal, airway, pleural and mediastinal complications are also summarized.

CONCLUSION

Early diagnosis and treatment of pulmonary tuberculosis prevents the development of late sequelae, thereby reducing the morbidity and mortality associated with it. Knowledge of these complications helps both radiologists and the respiratory physicians in ruling out the active disease and unnecessary treatment.

KEYWORDS

Tuberculosis, Fibrosis, Bronchiectasis, Emphysema, Calcification.

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BACKGROUND

Tuberculosis (TB) is an ancient disease which is associated with high morbidity and mortality. There are evidences of spinal tuberculosis even in the vertebrae of Neolithic men in Europe and of Egyptian mummies.[1] Till now it remains the world's leading cause of death from a single infectious agent.[2] Tuberculosis is caused by a bacterium named Mycobacterium tuberculosis which is an aerobic, non-motile non-spore forming rods. They are about 2-4 um in length and 0.3 um in thickness. There are several species of the genus Mycobacterium which may cause disease to any part of the body, although its manifestations are predominantly seen in chest. The lungs are the most common and often the initial sites of involvement. Chest involvement is most commonly seen in pulmonary, followed by lymph nodes and pleura, which are included under extrapulmonary tuberculosis.

The Tubercular bacilli are gram positive though they do not take up the stain easily. Mycobacteria retain the primary stain even after decolourisation with acid alcohol, hence they are being termed as 'acid fast'. A counter stain is usually employed to highlight the stained bacilli for easier identification. This acid and alcohol fastness can be demonstrated by the Ziehl-Nielsen and Fluorescent staining procedure with some modifications. Direct exposure to heat, sunlight and radiation kills these bacteria, but these are fairly resistant to drying and some disinfectants.

Pulmonary tuberculosis is a chronic infectious disease and the source of infection is an infected person. Usually the patients with pulmonary cavitary lesions; will be smear positive and are highly infectious, whereas in patients whose tubercle bacilli cannot be demonstrable in the sputum after

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staining, or in patients with culture negativity are relatively non-infectious.[3]

Most common route for transmission of the disease is airborne, and that the unit of infection is a small particle called a droplet nucleus; which consists of a single bacillus; the smaller the droplet the more liable it is to deposit in alveolar surfaces, while the larger particles are trapped in larger airways and cleared by mucociliary mechanism.

Tuberculosis is a global health problem and is the major cause of suffering and death since it evolved. It is also the second common infectious cause of death, after human immunodeficiency virus (HIV). As per the global TB report 2017, the estimated incidence of Tuberculosis in India was approximately 28 lakhs; which accounts for almost a quarter of the world's TB cases. India accounted for 26% of total cases of TB worldwide in 2012[4] and it's one of the leading causes of mortality, killing two persons every 3 min, nearly 1000 every day.[5]

Radiological examination had an important role in the diagnosis and treatment of pulmonary TB in the past century. After the discovery of the X-rays in 1895, it became an important tool in identifying pulmonary lesions. As the quality of examination improved, the benefits become significantly better. Earlier the lesions were diagnosed; patient received earlier treatment and lower rates of complications.

Although radiology is one of the commonest tools used in diagnosing tuberculosis, in this study we are highlighting only on the imaging features of sequelae and complications of thoracic tuberculosis affecting the lung parenchyma, airways, vessels, mediastinum and pleura after giving the full course of tuberculosis chemotherapy. Hence as a part of the study we mainly used Chest radiograph- posteroanterior view and computed tomography (CT) as the main imaging modalities. Ultrasonography was used only in cases with pleural pathology.

MATERIALS AND METHODS

This is a prospective and nonrandomized study conducted at Department of Respiratory medicine, a tertiary care hospital attached to Karwar Institute of Medical Sciences, Karwar, India between November 2016 and August 2018. Cases were collected from the outpatient departments and the wards. A total 172 patients were enrolled in the study, who had received treatment for a complete course for one or more time and declared cured.

As a part of the study we took detailed history which included antituberculosis treatment and thorough physical examination was done. Routine haematological investigations which included complete hemogram, erythrocyte sedimentation rate (ESR), Random blood sugar, Serum creatinine, Chest radiograph-PA view, Sputum smear microscopy by fluorescent staining, and culture for AFB were the initial investigations performed in adults. Chest radiograph was frequently employed as the initial test to evaluate unexplained cough and was the primary modality for diagnosis and follow-up. Each patient had a sputum examination done on 2 different occasions, sputum being collected according to WHO recommendation & stained by fluorescent stain for AFB. All radiographs were interpreted by one radiologist and one pulmonologist to reduce the inter observer error. CT was done whenever it was feasible and indicated.

Multi drug resistant tuberculosis and HIV positive patients receiving TB treatment were excluded from the study. We had also omitted the patients who had signs and symptoms of active tuberculosis with microbiologically proven disease.

RESULTS

A total of 172 patients were enrolled in the study period and the mean age of study population was 46.3 years. Total numbers of male patients were 121(70.3%) and females were 51 (29.7%) with male: female ratio was 12:5.

We had enrolled all the patients who completed the anti-tubercular therapy during study period and presented to the Department of Respiratory medicine. Out of 172 patients who were enrolled in the study, 63 patients had received the treatment for the first time and 109 patients were recurrent cases who had completed the treatment more than once. 45.3% of the study population were either active smokers or ex-smokers. Cough with/without expectoration was the commonest symptom that persisted even after full course of the therapy seen 54.1% of study population, followed by dyspnoea in 32%; haemoptysis in 12.8% and chest pain in 9.3%. Radiographically 40.1% of patients had right sided involvement, 25% had left sided and 20.9% had bilateral involvement of the lung. However, in 41 patients (23.8%) tuberculosis was healed without leaving any sequelae and they were asymptomatic. Demographic and clinical manifestations of study population are enlisted in Table 1.

Among 172 patients who were enrolled in the study population, only 131 patients were having one or the other complications which we call it as post tuberculosis sequelae and in 41 patients there were no signs either clinically or radiologically. Post Tb complications in our studies were divided into four categories, namely parenchymal, airway, pleural and mediastinal complications. Parenchymal complications were the most common type; among this fibrotic bands were the commonly found radiological complication in 65.6% (Figure 1). Other subdivisions include cavitation (15.1%), emphysema (25%), calcifications (23.8%) (Figure 2), destroyed lung (5.8%) (Figure 3) and fungal ball (2.3%) (Figure 4). Airway complications were bronchiectasis in 38.9% (Figure 5), and bronchial stenosis in 1.1%. Pleural complications were chronic pneumothorax, sometimes associated with bronchopleural fistula and pleural thickening/fibrothorax in 1.1% cases each ((Figure 6), Mediastinal complications were less common and were mediastinal fibrosis and lymph node calcification.

Sl. No.	Characteristics of Study Population	
1.	• Total No. of Patients	172
2.	• Mean Age	46.3
	- Age Range (Yrs.)	19-80
3.	• Sex	
	- Male	121(70.3%)
	- Female	51(29.7%)
4.	• History of Smoking	78 (45.3%)
5.	• History of Anti TB Treatment	
	- Once	63 (36.7%)
	- More Than Once	109(63.3%)
6.	• Symptomatology	
	- Cough	93 (54.1%)
	- Expectoration	59 (34.3%)
	- Dyspnoea	55 (32.0%)
	- Haemoptysis	18 (12.8%)
	- Chest Pain	16 (9.3%)
7.	• Side of Involvement	
	- Unilateral	95 (55.2%)
	- Bilateral	36 (20.9%)

Table 1. Characteristics of Study Population - Includes Demographics, Symptomatology & Pulmonary Involvement

Sl. No.	Characteristics of Study Population	
1.	• Parenchymal Complications	
	- Fibrotic Bands	86 (65.6%)
	- Residual Cavitation	26 (15.1%)
	- Compensatory Emphysema	43 (25.0%)
	- Calcifications	41 (23.8%)
	- Destroyed Lung Syndrome	10 (5.8%)
	- Fungal Ball	4 (2.3%)
2.	• Airway Complications	
	- Bronchiectasis	67 (38.9%)
	- Bronchial Stenosis	2 (1.1%)
3.	• Pleural Complications	
	- Chronic Pneumothorax	2(1.1%)
	- Fibrothorax/ Pleural Thickening	2(1.1%)
4	• Mediastinal Complications	
	- Mediastinal Fibrosis	1 (0.6%)
	- Lymph Node Calcification	1(0.6%)

Table 2. Radiological Changes in Patients with Post Tuberculosis Sequelae

Figure 1. Fibrosis

Figure 2. Calcifications

Figure 3. Destroyed Left Lung

Figure 4. Bilateral Upper Lobe Fingal Balls

Figure 5. Bilateral Bronchiectasis

Figure 6 - Bilateral Pleural Fibrosis and Plaques

DISCUSSION

Tuberculosis is one of the major public health problems, particularly in the developing countries like India. Lungs are the most common and often first site of involvement in tuberculosis. Early diagnosis and treatment is extremely important not only for ensuring the cure but also for preventing the complications that arise and persist even after the TB lesions are healed. In a patient suspected to have pulmonary tuberculosis, postero-anterior view of the chest is often the first imaging modality and mostly adequate for diagnosis and subsequent follow up of such patients. Other imaging modalities include computed tomography, ultrasonography, magnetic resonance imaging.

The number of male patients were 121 out of 172 total patients, thus males represented bulk of the study population (70.3%). Male preponderance was noticed in similar studies across the world as well.[6,7] Since males represent the active sector of the community in India who move around seeking education, employment & usually live in crowded common places like urban slums, hostels etc., most probably with poor housing & under-nutrition conditions which render them easy victims to the disease especially from rural to urban areas & thus get more in contact with the disease. We also noticed one more important risk factor i.e., majority of the patients came from the low socio-economic groups of population.

45.3% of the study population were either active smokers or ex-smokers, which might have also contributed in developing some of the parenchymal complications like emphysema, bronchiectasis etc. Also smoking & alcohol intake do assist the development of tuberculosis especially if accompanied by the socioeconomic conditions mentioned earlier.[8] In the present study, 63 patients had received the treatment only once and 109 patients had received anti tubercular chemotherapy more than once. This is also one of the contributing factors for development of post tubercular complications because of chronicity of the disease.

Ali MG, Muhammad ZS et al in their study mentioned that 91% of their patients developed post treatment parenchymal and pleural sequelae. 65% had developed unilateral involvement and 12% had developed bilateral involvement[9] which slightly differs from ours, where in the complications developed in 76.1% of our study population and in 23.9% of cases complete resolution was seen. This can be explained by earlier presentation to health facility and early treatment leaves no complications in the lung. In our study unilateral involvement was seen in 55.2% and bilateral involvement in 20.9% of the study population, which is in par with the study done by Ali MG et al.[9]

Cough was the commonest respiratory symptom which was seen in 54.1% most often associated with expectoration followed by dyspnoea on exertion. This is mainly because of the tuberculosis sequelae, essentially similar in those with other lower respiratory tract infections, i.e., chronic bronchitis, bronchiectasis, diffuse panbronchiolitis, chronic pulmonary emphysema etc.,[10]

In our study, diagnosis of post Tb sequelae was based on clinical history and radiological findings. Each patient was ruled out of active tuberculosis by sputum examination done on 2 different occasions, sputum being collected according to WHO recommendation & stained by fluorescent stain for AFB. All radiographs and whenever required CT chest were interpreted by one radiologist and one pulmonologist to reduce the inter observer error. Sputum for mycobacterium tuberculosis culture was routinely sent in all the patients. Electrocardiography and two-dimensional echocardiography were performed only in patients with signs and symptoms of cor pulmonale.

In the study conducted by Harada S, Harada Y et al. Pulmonary parenchymal complications were ranging from 40-65%;[11] which compares well with our study where in parenchymal complications were seen in 65% of the cases. Commonest radiological findings being fibrotic bands; compensatory emphysema and residual cavities etc. The incidence of cavitation and destruction of the lung parenchyma will be more when there is delay in delay in diagnosis and treatment initiation.

Bronchiectasis may develop as a result of tuberculous involvement of the bronchial wall and subsequent fibrosis. In the study published by Hyae Young Kim et al.[12] Bronchiectasis is seen in 30%-60% of patients with active post primary tuberculosis which is in comparison with our study wherein the percentage of airway involvement is seen in 40.1%, bronchiectasis alone was seen in 38.9% of study population. Though bronchiectasis in pulmonary tuberculosis can occur be a part of cicatricial bronchostenosis which

occurs after local infection; it is mainly due to dilatation and destruction of the lung parenchyma, also called as traction bronchiectasis. Bronchiectasis that occurs mainly in the apical and posterior segments of the upper lobe are most likely because of tuberculous origin; at least in the TB specific countries like India. Tracheobronchial stenosis may be caused by granulomatous changes in the tracheobronchial wall or by extrinsic pressure from enlarged peribronchial lymph nodes. Although the diagnosis of bronchostenosis to be confirmed by bronchography, because of lack of availability and hazards associated with the procedure, CT was used as the diagnostic modality in our study.

Pleural complications like chronic pneumothorax, bronchopleural fistula and pleural thickening/ fibrothorax were also noted in our study which were in comparison with the other studies published.[11,12] Fibrosing mediastinitis is uncommon and involves the presence of excessive fibrosis in the mediastinum was seen only one patient. Although tuberculosis is an important cause of chronic mediastinitis, tuberculous mediastinitis is very rare or often misdiagnosed.[13]

Patients with a greater number of combinations of pulmonary sequalae radiologically presented to hospital with more severity of symptoms and the chronicity of symptoms.

CONCLUSION

There has been a wide array of radiological changes described as complications and sequelae to tuberculosis healing. One should be very thorough with these changes before managing them in their clinical practice. Earlier diagnosis and initiation of treatment prevents the late sequelae of the disease, which sometimes can lead to mortality as well.

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