

ORIGINAL RESEARCH

UNILATERAL COMPLETE LUNG DESTRUCTION IN TUBERCULOSIS: IMAGING SPECTRUM IN A TERTIARY CARE HOSPITAL IN INDIA

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ABSTRACT

Background: Tuberculosis is one of the world's potentially life-threatening communicable diseases. The disease burden is more in developing countries. Pulmonary tuberculosis can lead to several serious complications. Unilateral lung destruction and complete destruction of a major part of lung or entire lung is common, and it results from parenchymal and airway involvement. Chest radiographs & computed tomography of chest is the mainstay in the detection of the destroyed lung.

Objective: To describe the radiographic and computed tomographic findings in patients with tuberculous unilateral lung destruction.

Martial and Methods: In this report, we present a review of 50 patients with UTLD secondary to TB. Case records of the patients were retrospectively evaluated for clinical data and treatment history. Retrospective review of the images was performed by two radiologists and relevant findings were studied. Important findings were noted.

Results: A total of 50 patients with unilateral complete lung destruction were evaluated. Age ranged from 25 to 68 years. Chest radiograph showed a small opacified hemithorax with mediastinal shift, crowding of ribs. Computed tomography showed loss of lung volume with fibrosis, bronchiectasis, and cavities. Left lung destruction was predominant (41/50, 82%). 22(44%) patients had fibrosis or cavities in contralateral lung. 16 (32%) patients had features of active disease in contralateral lung. 3(6%) patients had aspergilloma in the affected lung.

Conclusion: Males are more commonly affected. Left lung is more commonly involved compared to the right. Characteristic radiological findings are unilateral volume loss, reduced size of the ipsilateral pulmonary artery and pulmonary veins and hyperinflation and herniation of contralateral lung.

Keywords: lung destruction, unilateral, computed tomography, lung fibrosis, tuberculosis.

INTRODUCTION

Tuberculosis is one of the world's potentially life-threatening communicable diseases. An estimated 9.6 million people developed TB while 1.5 million died from the disease in 2014.^[1] The disease burden is more in developing countries like India. Apical tuberculosis with predominant upper lobar cavities and destructive lesions are well documented both in endogenous reactivation and exogenous reinfection.^[2] Nonetheless, tissue destruction is not confined to upper lobes alone. Unilateral massive lung destruction can occur after either primary or reinfection tuberculosis.^[9] Current research is centered on microbial persistence and MDR TB.

Pulmonary tuberculosis can lead to several serious complications. Unilateral lung destruction is one such complication that occurs in the later stages of disease progression and reactivation.^[3] End stage tuberculosis leading to complete destruction of a major part of lung or entire lung is common and it results from parenchymal and airway involvement.

The common clinical presentation in patients with lung destruction are frequent and severe respiratory infections, hemoptysis, fever, malaise, ill health. They may also present with more life-threatening conditions like septicemia, fungal infections, massive hemoptysis, or respiratory failure. This amounts to significant morbidity and mortality.^[4]

Majority of patients presenting this way is largely due to poor compliance to the anti-tubercular treatment or late presentation. There have been fewer studies that have outlined this problem.

Chest radiographs & computed tomography of chest is the mainstay in the detection of the destroyed lung. Chest radiographic features of the destroyed lung include opaque hemithorax with ipsilateral mediastinal shift, crowding of ipsilateral ribs and herniation of the contralateral lung. Bronchiectasis, pleural thickening is frequently associated. Chest radiographic features are depicted clearly in computed tomography.

This complication has been previously reported in a review of 5,926 cases of TB in 74 patients (1.3%).^[3] However, there is dearth of studies on Indian population. Knowledge of the most important radiological finding in such conditions is essential. Total unilateral lung destruction is a late complication that requires years to develop; so, it is difficult to estimate the influence of other superimposed non-tubercular infections and to assemble a large sample or perform a prospective study with significant data.^[5]

In this report, we present a review of 50 patients with UTLD secondary to TB in our center, with the aim of describing the radiological findings in chest radiographs and chest CT of this late and uncommon complication of TB. As it is important to be familiar with the significant radiological findings in this condition.

Aims and objectives

To describe the radiographic and computed tomographic findings in patients with tuberculous unilateral lung destruction.

MATERIALS & METHODS

Patients referred to RIMS teaching hospital for evaluation of TB sequelae with radiological features suggestive of unilateral lung destruction were included in the study. Case records of the patients were retrospectively evaluated for clinical data and treatment history. Chest radiographic images and computed tomographic images were retrieved from the picture archiving and communication system (PACS). Retrospective review of the images was performed by two radiologists and relevant findings were studied. Main bronchus on affected side, mediastinum and its structures, vascular structures, parenchymal lesions including fibrosis, cavities & bronchiectasis and pleural involvement were assessed on computed tomographic images.

RESULTS

A total of 50 patients with unilateral complete lung destruction were evaluated. All these patients had either unilateral lung destruction alone with another lung healthy or with lesions in the contralateral lung. Age ranged from 25 to 68 years. Maximum number of patients were seen in the age group of 45 to 60 years. There was male predominance; the male to female ratio was 1.9:1. All the patients gave history of pulmonary tuberculosis diagnosis. Most of the patients presented with breathlessness (90%) or a repeated event of respiratory infection (70%). Few patients reported self-limiting haemoptysis (10%). All the patients gave history of anti-tuberculous treatment, 15 patients (30%) gave history of discontinuing the ATT.

Chest radiograph showed a small opacified hemithorax with mediastinal shift, crowding of ribs. Lucent areas were seen, corresponding to contralateral lung herniation, bronchiectasis, or cavities (Figure 1 & 2A).

Computed tomography showed loss of lung volume with fibrosis, bronchiectasis, and cavities (Figure 2B, 2C, 3). There was herniation of contralateral lung, crowding & hypertrophy of ipsilateral ribs, proliferation of extra pleural fat and decrease in the diameter of pulmonary artery and veins on the affected side. On CT, two patterns were identified: 1. unilateral lung destruction with residual cystic bronchiectasis (40/50, 80%) and 2. unilateral lung destruction without residual cystic bronchiectasis (10/50, 20%).

Left lung destruction was predominant (41/50, 82%). 22(44%) patients had fibrosis or cavities in contralateral lung. 16 (32%) patients had features of active disease in contralateral lung and 14 of these patients showed sputum AFB positivity. 3(6%) patients had aspergilloma in the affected lung. None of the patients showed intraluminal obstruction or extraluminal compression involving the main bronchus.

Table 1: Characteristics of patients with unilateral tuberculous lung destruction

Characteristic	Number (%)
Age:	
25 to 35 yrs	7(14%)
36 to 45 yrs	15(30 %)
45 to 60 yrs	28(56%)
Gender	
Male	33(66%)

Female	17(34%)
Side of Destruction:	
Right	41(82%)
Left	9(18%)

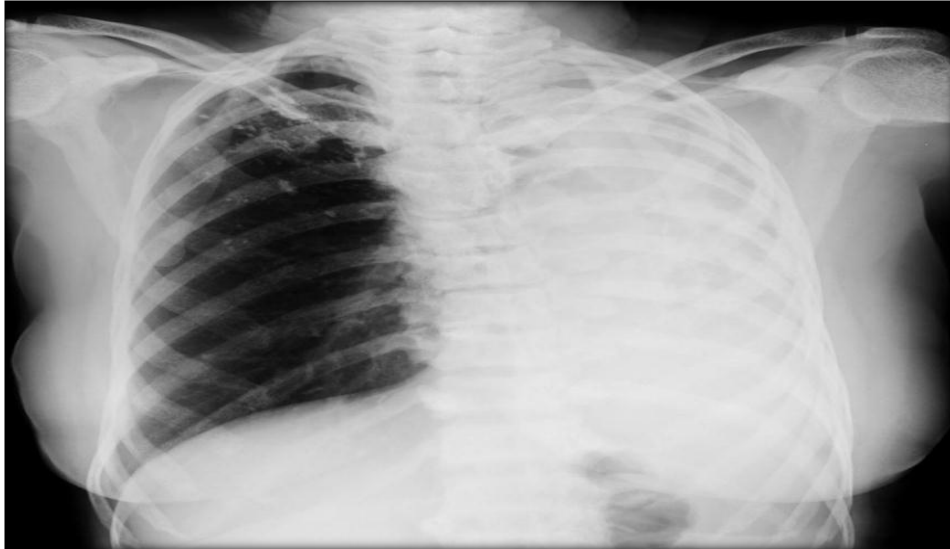


Figure 1: Chest radiograph showing unilateral lung destruction on left side with parenchymal calcifications on right side

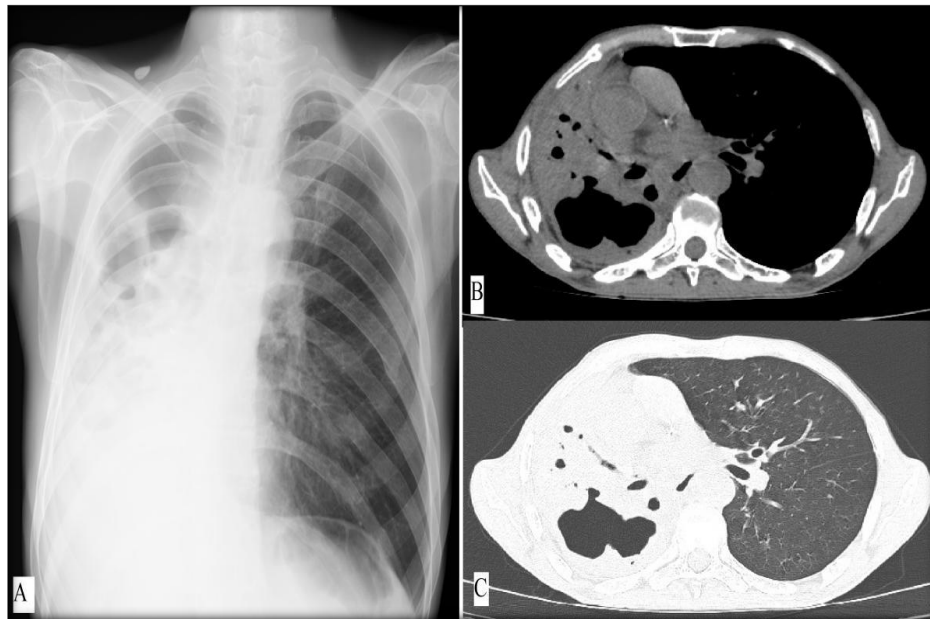


Figure 2: Chest radiograph (A) and CT (B&C) showing right lung destruction with residual bronchiectasis.



Figure 3: CT showing left lung destruction with no bronchiectasis.

DISCUSSION

Extensive destruction of the lungs, noted in radiological studies is termed as Destroyed lung.^[6] It is a condition that describes a non-functional lung, that is associated with recurrent or chronic lung infection.^[8] Destroyed lung is characterised by markedly reduced ventilation to perfusion ratio.^[7] Tuberculosis is one of the commonest causes of destroyed lung, which is inflammatory in nature.^{[7],[8]}

Destroyed lung leads to complications like respiratory insufficiency, massive haemoptysis, empyema, septicaemia, secondary fungal infections, and left to right shunts.^[6]

Primary disease or reinfection can lead to unilateral tuberculous lung destruction, which is a known entity.^{[9],[10]} Patients present with unilateral lung destruction either first time, or after treatment completion, or as non-responders to treatment owing to drug resistance. In a study done by Rajasekaran S et al,^[11] 51% of 871 newly diagnosed patients had far advanced tuberculosis because of delay in seeking treatment. It is common to see patients with significant lung destruction despite potent short course drug regimen. These drugs are potent bactericidal and targeted for preventing lung destruction

In our study 50 patients with unilateral tuberculous lung destruction were included. Destruction of left lung (82%) was more common in our study. In other earlier studies,^{[12],[5],[13]} left lung destruction was found to be higher. This predominance may be due to the anatomical characteristics of left main bronchus, which is considerably longer and narrower than the right bronchus,^[12] and the tight mediastinum through which it traverses.^[14] Also, the left main bronchus has a more horizontal course than the right main bronchus which might influence drainage of secretions.^[11]

The destroyed lung receives decreased pulmonary arterial blood flow which results in reduction in the delivery of chemotherapeutic agents to the affected lung. This leads to ineffective killing of tubercle bacilli resulting in microbial persistence.

As a result, relapsed tuberculosis, and treatment failures with MDR TB are a common occurrence in patients with destroyed lung.^[14]

Decreased diameter of pulmonary arteries and veins was observed in all cases of lung destruction on the affected side, similar findings were reported by DV Porres et al in their study.^[5] This finding is consistent with a haemodynamic factor that leads to bacterial dissemination to the other parts of the lung.^[12]

Reduction in pulmonary artery blood flow associated with bronchial obstruction, accumulation of secretions, or lung parenchymal infection leads to shunts between the pulmonary and bronchial arteries.

When these shunts are associated with stasis of lymph and increased oxygen tension, it causes retrograde broncho-pulmonary flow that increases dissemination of bacteria and destruction of the affected lung.^[12]

Hypertrophy of the ipsilateral ribs and proliferation of extra pleural fat was noted in all patients and is likely due to chronicity.^[5] Similar findings are observed in chronic inflammatory conditions of the lung or pleura.

Findings such as areas of fibrosis, atelectasis, bronchiectasis, and calcified granulomas were seen in the contralateral lung in 22 patients.

The destroyed lung can cause life threatening complications necessitating urgent medical attention. Massive haemoptysis, septicaemia, and left-right shunt leading to pulmonary hypertension and respiratory failure.

The differential diagnosis of destroyed lung includes granulomatous diseases, fungal infections, total lung collapse, chronic pleural disease, previous lung surgery and pulmonary agenesis/hypoplasia. Large number of patients with unilateral lung destruction present with residual lesions and calcifications in the contralateral lung.

Together with the clinical history of lung tuberculosis, it can help to support the diagnosis of post tuberculous lung destruction.

CONCLUSION

Unilateral complete lung destruction is an irreversible complication of pulmonary tuberculosis. Inadequate and insufficient treatment of pulmonary tuberculosis and lack of proper follow-up creates the ground for the destruction of the lung. Males are more commonly affected. Left lung is more commonly involved compared to the right. Characteristic radiological findings are unilateral volume loss, reduced size of the ipsilateral pulmonary artery and pulmonary veins and hyperinflation and herniation of contralateral lung. Chest radiograph & computed tomography scans are also critical in detecting the bronchial neoplasms and mediastinal masses. Correct diagnosis and radiological follow-up are important in these patients.

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