Radiology Forum

# Pulmonary Fibrosis and Emphysema

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## CLINICAL SUMMARY

A 58-year-old male presented with symptoms of progressive dyspnoea on exertion and predominantly dry cough of six months duration. He was a cigarette smoker with a smoking index of 10 pack years. He had no history of fever, exposure to dusts or drug therapy. There was no history of similar illness in the family members or any symptoms suggestive of connective tissue disease (CTD). On physical examination, clubbing was observed and there were bibasilar fine end-inspiratory crackles on auscultation. Oxygen saturation by pulse oximetry showed significant exercise desaturation from 94% to 77%.

## INVESTIGATIONS

The chest radiograph (postero-anterior view) showed bilateral reticulonodular opacities (Figure 1).

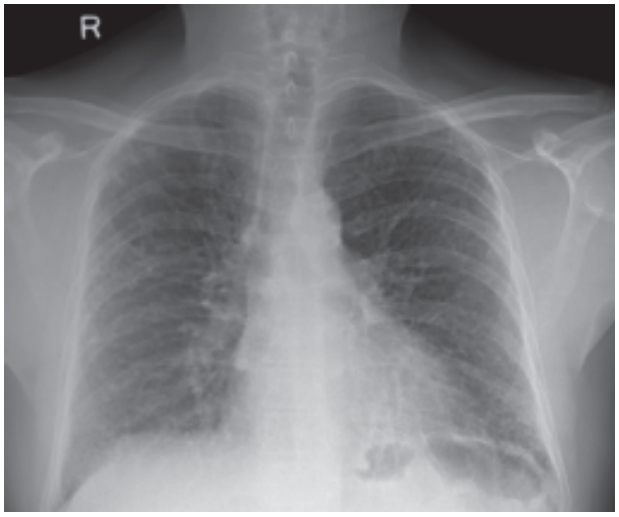


**Figure 1. Chest radiograph (postero-anterior view) showing bilateral reticulonodular opacities.**

High resolution computerised tomography (HRCT) of thorax (Figure 2A and B) showed ill-defined areas of intralobular interstitial and septal thickening involving bilateral lung parenchyma with a peripheral distribution pattern and microcystic honey-combing. In addition, extensive centrilobular

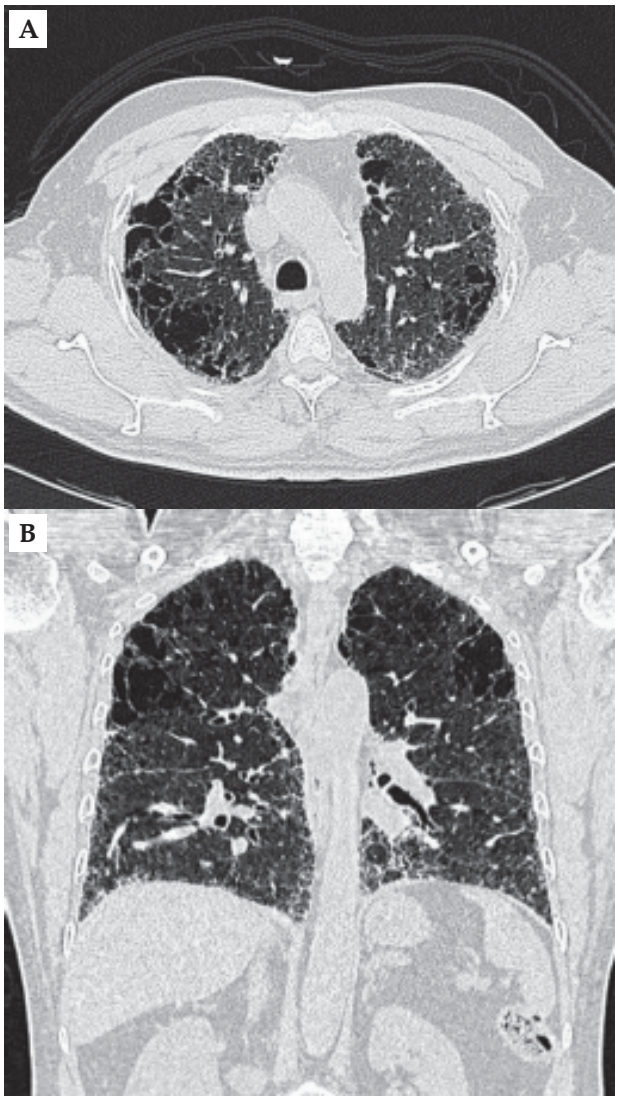


**Figure 2 (A & B). High resolution computerised tomography of thorax (axial and coronal section) showing ill-defined areas of intralobular interstitial and septal thickening involving bilateral lung parenchyma showing peripheral distribution pattern and microcystic honey-combing and extensive centrilobular emphysema involving both the upper lobes.**

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emphysema was seen involving both the upper lobes. Estimated pulmonary artery systolic pressure (PASP) by trans-thoracic two-dimensional echocardiography was 25mmHg. Spirometry showed relatively preserved lung volumes, with forced expiratory volume in the first second ($FEV_1$) of 70% predicted; forced vital capacity (FVC) of 63% predicted; and $FEV_1$/FVC ratio of 89%. Despite well preserved lung volumes, diffusion capacity of lung for carbon monoxide (DLCO) was 33% of predicted. Haemogram and serum chemistry were normal.

## DIAGNOSIS

*Combined pulmonary fibrosis and emphysema (CPFE).*

## DISCUSSION

Combined pulmonary fibrosis and emphysema is a recently recognised radiologically defined syndrome. In this syndrome two different disease states, emphysema and pulmonary fibrosis coexist and manifest into a unique and distinct disease state that differs from either of the two components.[1] In view of unique radiological, clinical features and prognosis, CPFE has been described as a syndrome.[2] The histopathological evidence of combination of both emphysema and pulmonary fibrosis was initially provided by Auerbach *et al*.[3] Later in 1990 the radiological description of CPFE was provided by Wiggins *et al*[4] in a series of 8 patients which was called coincidental cryptogenic fibrosing alveolitis and emphysema based on chest computed tomographic (CT) studies.

The present well-defined description of CPFE was provided by Cottin *et al*[1] in a study involving 61 patients. The exact prevalence of CPFE at present is not known though it has been suggested to be between 5% and 10% of cases of diffuse interstitial lung diseases. The pathogenesis of CPFE is not well understood. It has been suggested that environmental factors act as a trigger in the presence of genetic susceptibility with tobacco smoke playing a central role. Male gender and tobacco smoking are the most commonly associated risk factors for the development of CPFE. Agrochemical substances have also been suggested as one of the environmental triggers.[5] In addition to the classical form of CPFE occurring in male smokers, an associated form of CPFE has also been described in association with CTD. The patients with CTD-associated CPFE tended to be younger women, however, they had similar smoking history and had less adverse prognosis. Rheumatoid arthritis, systemic sclerosis and mixed CTDs were the predominant CTDs associated with CPFE.[6] The studies of CPFE in Asian populations have shown an unexpected high prevalence of lung malignancy in association with CPFE perhaps due to exposure to tobacco smoke.[7,8]

Clinical manifestations of CPFE include exertional dyspnoea, cough with or without sputum production, chest pain and wheeze. Exertional dyspnoea is the most common and predominant symptom. Digital clubbing and end-inspiratory fine (velcro) crackles mainly in the basal regions on physical examination in patients with CPFE are the predominant findings.[1,7,9] The diagnosis of the disease is established by HRCT findings. The radiological diagnostic criteria based on the chest HRCT were defined by Cottin *et al*.[1] The first feature was the presence of emphysema with upper lobe predominance. The second feature was the presence of diffuse parenchymal lung disease with significant pulmonary fibrosis that was defined as reticular opacities with subpleural and lower zone predominance, honey-combing, architectural distortion and/or traction bronchiectesis or bronchiolectesis. Further, for the diagnosis of CPFE the emphysematous lesions were quantified and graded as percentage and was required to be more than 10% of the affected lung.[1,9] Emphysematous regions show centrilobular emphysema bullae and para-septal emphysema. Para-septal emphysema has been described as characteristic of CPFE in view of its presence in more than 90% of patients with CPFE in most case series. Three HRCT patterns have been described based on transitional area between emphysema and pulmonary fibrosis in patients with CPFE: *(1)* progressive transition with diffuse emphysema and zone of transition between bullae and honey-combing; *(2)* para-septal emphysema with predominant subpleural bullae of enlarging size at bases; and *(3)* separate processes with independent areas of emphysema and fibrosis.[10]

Lung functions in CPFE are often well preserved in contrast to the severity of symptoms and co-existence of emphysema and pulmonary fibrosis. Forced vital capacity, forced expiratory volume in the first second and total lung capacity are either normal or in subnormal ranges.[1,11] The preserved lung function in CPFE may be due to simultaneous presence of emphysema and pulmonary fibrosis, wherein increase in compliance due to emphysema compensates for loss of volume due to fibrosis. However, the diffusion capacity which is a marker of gas diffusion across alveolo-capillary membrane is significantly reduced. The markedly reduced DLCO may be due to the combined effect of emphysema and pulmonary fibrosis and the degree in reduction cannot be accounted for either emphysema or pulmonary fibrosis in isolation.

Pulmonary hypertension appears to have a very high prevalence in CPFE ranging from 47% and 90% and the prevalence is much higher than what could be seen in emphysema or pulmonary fibrosis alone.[1,9]

Further, the pulmonary hypertension in CPFE is usually of higher severity. The presence of pulmonary hypertension is the single most important factor predicting mortality, and thus, poor outcome.[1,9,12] Other factors that are associated with worse prognosis have been identified as reduced forced vital capacity, reduced cardiac index, tachycardia and low diffusion capacity. There is no definitive therapy at present for CPFE. The treatment options include smoking cessation, correction of hypoxaemia, pulmonary rehabilitative measures and lung transplantation.

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