Original Research Article

Evaluation of high-resolution CT chest findings in interstitial lung disease in a tertiary care hospital

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Abstract

Background: CT has an increasing role in the radiologic evaluation of occupational/ environmental lung disease. The high-resolution CT (HRCT) findings of siderosis, talcosis, berylliosis, calcinosis and hypersensitivity pneumonitis are described. AIM OF THE STUDY: The purpose of this article is to describe the high-resolution CT (HRCT) features of rare occupational lung diseases. **Methods:** The HRCT chest was done from June 2018 to June 2019 in 50 patients with occupational history related to the following diseases with a minimum of 5 years of occupational exposure with symptoms of cough with/ without sputum. **Results:** We present 50 cases of unusual occupational lung diseases and their HRCT findings. The diseases studied were siderosis, talcosis, berylliosis, calcinosis and hypersensitivity pneumonitis. **Conclusion:** Occupational lung diseases represent a frequently diagnosed work-related condition. High-resolution CT (HRCT) is fundamental for the quantification of disease severity and the prognosis and identification of coexisting or alternative diseases

Key Words: Occupational Lung Disease, HRCT Chest, Siderosis, Talcosis.

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INTRODUCTION

The term interstitial lung disease (ILD) comprises more than 210 separate disease entities, each having its separate and often unique radiological manifestations. Because the clinical presentation of most of these diseases is similar, high-resolution computed tomography (HRCT) becomes a valuable tool in narrowing the differential diagnosis.[1]The importance of HRCT is further underlined by the fact that there is no gold-standard diagnostic test for ILD. The purpose of this article is to describe and illustrate the HRCT features of patients with rare occupational lung diseases.The clinical, radiologic and pathologic manifestations of occupational lung disease may be identical to nonoccupational variants because of the lung′s limited capacity of response to injury.[2] A high degree of suspicion directing a thorough occupational history to search for potential exposures is the key to an accurate diagnosis. Diagnosis of occupational lung disease requires definite history of exposure to an agent known to cause interstitial lung disease (ILD), an appropriate latency period, a consistent clinical presentation, physiologic and radiologic pattern and exclusion of other known causes of ILD.[3] When these conditions are fulfilled, the need for lung biopsy can be obviated. A biopsy needs to be performed for atypical presentations, both clinical and radiological, or when the exposure is to a new or poorly characterized agent. Imaging plays an indispensable role in the evaluation of occupational lung disease. The radiograph of chest is the most important diagnostic tool for evaluation. It can be

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unique or highly suggestive of an occupational disorder and may be sufficient, along with appropriate exposure history, to establish a diagnosis. [4]Despite the well-established role of chest radiography inaccurately and inexpensively displaying a wide range of pulmonary pathology, equally well-established limitations have been documented. The findings can be nonspecific and the sensitivity low, missing as many as 10 to 15 percents of cases with pathologically documented disease. It has been proved beyond doubt that CT, particularly high-resolution CT (HRCT), is superior to chest radiography in the detection of parenchymal abnormalities, is more accurate in providing differential diagnosis, and is free from considerable interobserver variation in its interpretation.[5] The application of CT to the occupational lung diseases attempts to describe morphological feature of respiratory manifestation more adjacent to pathology. It is indicated as a thorough investigation for positive cases screened by chest radiograph. [6]The utility of CT as a screening modality is still a question of debate. Cost and availability of the test as well as radiation issues are the reasons for excluding CT from screening tests.[7]

METHODS

The HRCT chest was done from 2018-2019 in 50 patients with occupational history related to the following diseases with a minimum of 5 years of occupational exposure with symptoms of cough with/ without sputum. We briefly review the high-resolution computed tomography (HRCT) appearance of a wide spectrum of occupational lung diseases. The HRCT findings were evaluated in the background of occupational history, and the histopathologic diagnosis was obtained through transbronchial or CT-guided biopsy, where the imaging findings were not specific. As HRCT detects pulmonary involvement of the occupational lung diseases earlier than conventional radiographs, intervention to exposed individuals in earlier stages would show a better outcome. Also a well-spread awareness of certain dusts like asbestos as a definite carcinogen among workers has lead to demand for more sensitive screening for dust-related respiratory diseases. To overcome the concern of radiation exposure, a low dose technique and acquisition of limited number of slices can be introduced while using CT for screening purposes. Magnetic resonance imaging (MRI) has a limited role in evaluation of patients with occupational lung disease. It is helpful for distinguishing between progressive massive fibrosis (PMF) and lung cancer. PMF will show hypointense signal on both T1W and T2W sequence whereas a lung cancer would be hyperintense on T2W sequence.

RESULTS

In the presence of a history of exposure and consistent clinical features, the diagnosis of uncommon occupational lung disease can be suggested by the characteristic described HRCT findings. We present 50 cases of unusual occupational lung diseases and their HRCT findings. The diseases studied were siderosis, talcosis, berylliosis, calcinosis and hypersensitivity pneumonitis. Silicosiderosis is seen in individuals involved in the mining and processing of iron ores, workers in iron and steel rolling mills, and foundry workers. HRCT findings in patients with talcosis caused by inhaled particulates include small centrilobular and subpleural nodules and heterogeneous conglomerate masses with internal foci of high attenuation that correspond to talc deposition. HRCT findings are parenchymal small nodules often clustered around the bronchi, interlobular septa, or in the subpleural region where the nodules may form pseudoplaques and interlobular septal thickening ground-glass opacities, honeycombing, conglomerate mass, bronchial wall thickening and hilar or mediastinal lymph nodes with amorphous or eggshell calcification. The characteristic HRCT manifestations in acute hypersensitivity pneumonitis consist of air-space consolidations. Findings in subacute hypersensitivity pneumonitis are patchy areas of ground-glass attenuation and small centrilobular nodules

DISCUSSION

SIDEROSIS[8,9]

Siderosis is caused by the accumulation of iron oxide in macrophages within the lung Siderosis is not usually associated with fibrosis or functional impairment. The radiologic abnormalities are reversible and may resolve partially or completely after exposure ceases HRCT shows widespread ill-defined small centrilobular nodules and, less commonly, patchy areas of ground-glass attenuation without zonal predominance. Emphysema is often seen The micronodules on CT correspond to dust macules, which are collections of dust-laden macrophages aggregated along the perivascular and peribronchial lymphatic vessels Inhaled iron with silica results in silicosiderosis (mixed-dust pneumoconiosis)

Siderosis in 45-year-old man with 10 pack-year smoking history and 25 years of exposure to arc-welding who presented complaining of cough

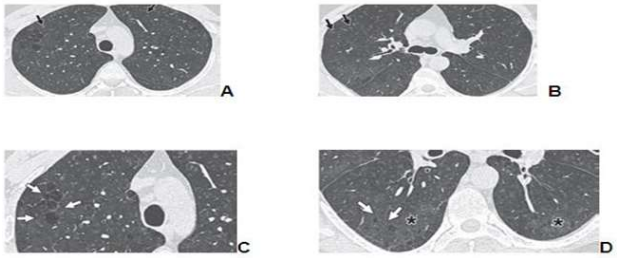

Figure 1:

A–D, High-resolution CT images (1-mm-thick sections) shows multiple small and poorly defined centrilobular nodules in the upper lobe of both lungs (*black arrows*, A and B). Centrilobular emphysema (*white arrows*, C and D) and areas of ground-glass attenuation (*asterisks*, D) independent zones are seen. Results of pulmonary function test were normal.

TALCOSIS[3,7,8]

It is a hydrated magnesium silicate used in the paper, plastics, rubber, building, paint, and cosmetic industries Exposure occurs as a result of inhalation or by IV administration Talc causes a nonnecrotizing granulomatous inflammation that leads to progressive fibrosis

Talcosis in 65-year-old man who worked for 5 years in magnesium silicate processing

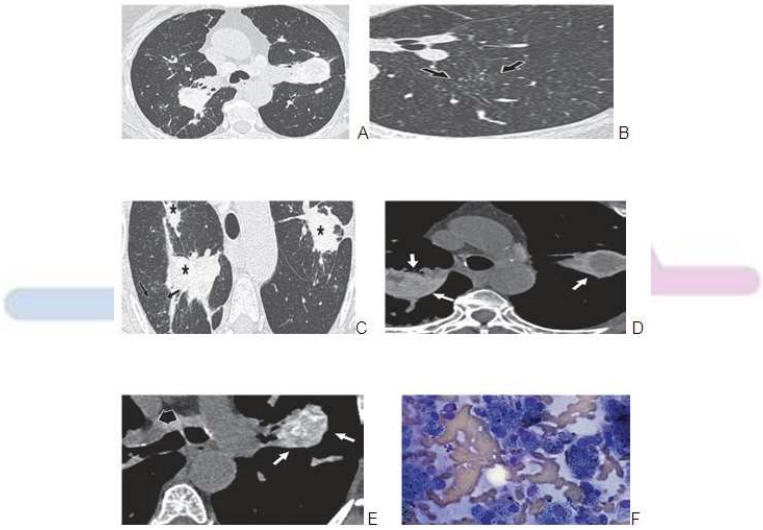

Figure 2:

A–E, High-resolution CT images (A–C) show small centrilobular nodules (*black arrows*, B and C) and conglomerated masses (*asterisks*, C) in upper lobes. When viewed at mediastinal windows (level, 10 HU; width, 300 HU) (D and E), masses are seen to contain high-attenuation material (*white arrows*), also seen in mediastinal lymph nodes (*black arrow,* E).F, Photomicrograph after lung fine-needle aspiration biopsy shows talc crystals in cytoplasm of alveolar macrophages, pathologic confirmation of talcosis.

BERYLLIOSIS[5,7,8]

Exposure to beryllium occurs in aerospace, ceramics, dentistry and dental supplies, nuclear weapons and reactors. There are two distinct types of lung injury related to beryllium exposure: an acute chemical pneumonitis and a chronic granulomatous disease Acuteberylliosis have become rare. Chronic beryllium disease represents a granulomatous hypersensitivity response. It has been associated with pulmonary carcinoma. A diagnosis of chronic beryllium disease requires a lung biopsy proving granulomatous inflammation and evidence of sensitivity to beryllium shown at blood testing or in bronchoalveolar lavage fluid HRCT findings are parenchymal small nodules often clustered around the bronchi, interlobular septa, or in the subpleural region where the nodules may form pseudoplaques and interlobular septal thickening ground-glass opacities, honeycombing, conglomerate mass, bronchial wall thickening, and hilar or mediastinal lymph nodes with amorphousoregg shell calcification

46-year-old man, who worked with dental supplies for 18 years, with advanced chronic beryllium disease.

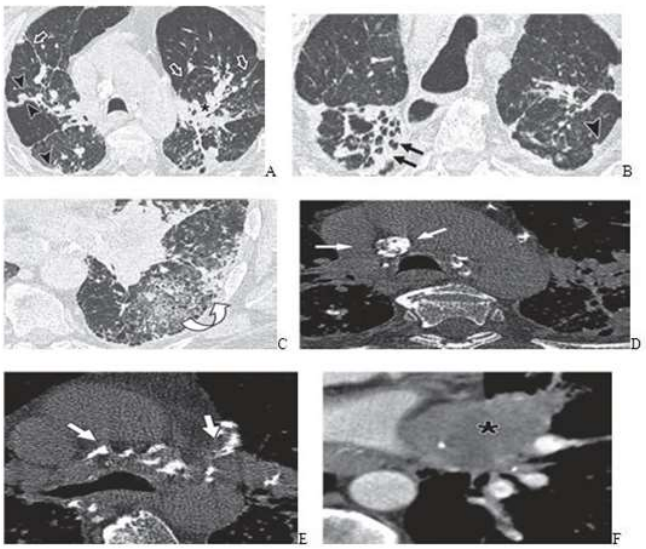

Figure 3:

A–F, High-resolution CT images show multiple small nodules (*arrowheads*, A), predominantly subpleural and conglomerate masses (*asterisk*, A and F) associated with interlobular septal thickening (*open arrows*, A), marked distortion and dilation of segmental bronchi (*black arrows*, B), and upper lobe volume loss. Ground-glass attenuation with reticulation and honeycombing (*curved arrow*, C), hilar and mediastinal lymph nodes with eggshell calcification (*white arrows*, D and E), and left hilar mass (*asterisk*, F) with invasion of left inferior pulmonary vein.

CALCICOSIS[2,3,9]

Calcinosis is caused by inhaling limestone dust. Pure limestone itself does not cause pneumoconiosis. The nodules show a foreign-body granulomatous response with several foreign-body cells. Light microscopy reveals the presence of numerous birefringent crystals with a chemical composition consistent with limestone. HRCT findings are the presence of widespread small nodules Calcicosis in a 45-year-old man who was marble worker for 16 years. A–D, High-resolution CT images (A–C)show small diffuse nodules (*arrows*, B and C) and some subpleural compounding pseudoplaques(*arrowheads*, B and C).Mediastinal window CT image (level, 15 HU; width, 350 HU)(D) shows pseudoplaques and mediastinal lymph nodes with high attenuation and punctate calcifications (*asterisks*, D)

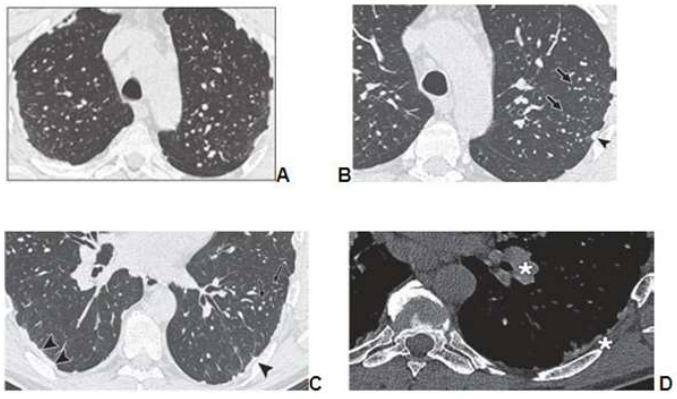

Figure 4:

HYPERSENSITIVITY PNEUMONITIS[10,11,12]

Hypersensitivity pneumonitis is a worldwide immunologic occupational lung disease. Humoral (type III) and cell-mediated (type IV) immune responses play a role in pathogenesis, resulting in alveolitis and granuloma formation. Although isocyanates are not organic dusts, the hypersensitivity pneumonitis they cause is identical to organic dust-related hypersensitivity pneumonitis [2].The characteristic HRCT manifestations in acute hypersensitivity pneumonitis consist of air-space consolidations.Findings in subacute hypersensitivitypneumonitis are patchy areas of ground-glass

attenuation and small centrilobular nodules (Fig. A). Other findings are focal air trapping on expiratory scans and cystic spaces presumably caused by partial bronchiolar obstruction.Chronic hypersensitivity pneumonitis is characterized by the presence of fibrosis superimposed on findings of acute or subacute hypersensitivity pneumonitis (Fig. B). Relative sparing of the lung bases usually allows its distinction from idiopathic pulmonary fibrosis

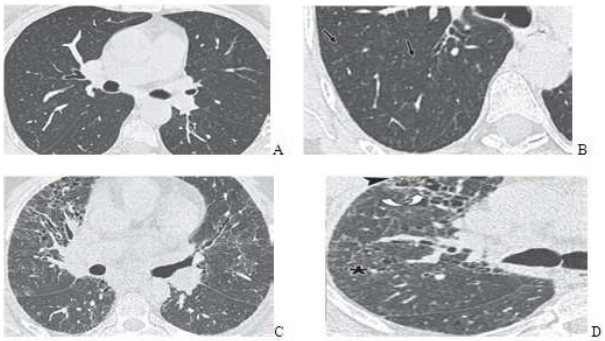

Figure 5:

HYPERSENSITIVITY PNEUMONITIS DUE TO OCCUPATIONAL EXPOSURE TO ISOCYANATES A and B, High-resolution CT images show widespread small centrilobular nodules (*arrows*, B) in 45- year-old woman who was furniture polisher. Findings show the subacute phase of hypersensitivity pneumonitis. C–D, High-resolution CT images show findings of fibrosis predominantly in upper lobes.

CONCLUSION

Occupational lung diseases represent a frequently diagnosed work-related condition. High-resolution CT (HRCT) is fundamental for the quantification of disease severity and the prognosis and Identification of coexisting or alternative diseases. However, no standardized quantification scheme is available for occupational lung diseases using CT. The aim of this article is to describe and illustrate the HRCT features of patients with rare occupational lung diseases. The characteristic radiological features suggest the correct diagnosis in some, whereas a combination of clinical features, occupational history, and radiological findings is essential in establishing the diagnosis in others. In uncommon occupational lung disease only the combination of appropriate exposure history, an appropriate latency period and a consistent clinical and radiological presentation can establish a correct diagnosis and avoid unnecessary radiation exposure or biopsies.

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