



PULMONARY ALVEOLAR MICROLITHIASIS: A PICTORIAL ESSAY

Radiology

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ABSTRACT

Pulmonary alveolar Microlithiasis is a rare disease of unknown etiology in which there is extensive intra-alveolar calcification. It presents with distinct radiological features which are diagnostic of this condition. Radiographic and CT scan findings are discussed with review of literature and illustrations. Tuberculosis, Sarcoidosis and Pneumoconiosis are important differentials.

KEYWORDS

Microlithiasis, alveolar calcifications, sand-storm

INTRODUCTION

Pulmonary alveolar Microlithiasis (PAM) is a rare and distinct disease of unknown etiology in which there is extensive intra-alveolar calcification. The first two cases were reported by Harbitz in 1918 and since then only a few cases were reported worldwide [1,2]. Castellana initially reported 424 cases in 2003 and nine years later reviewed the data of 1022 cases [3,4]. There are about 80 case reports from India as well [4,5]. In view of its rarity we are analyzing the spectrum of radiological features of PAM in this pictorial essay.

Etiopathogenesis

Although the exact cause of PAM is unknown, an inborn error of metabolism is a strong possibility [6]. Reduced mucociliary clearance of phosphate from the alveolar spaces has been reported as the main pathological defect by some authors (4). Probably Genetic factors are also involved. SLC34A2 is the gene identified in most cases with full penetrance. High rate of occurrence within families (nearly 50%) suggests an autosomal recessive hereditary factor [6]. Barbolini et al described two cases of pulmonary alveolar Microlithiasis in siblings [7]. Recently MS Shah and KI Nanavati also reported this entity in two siblings in a family [2]. Several authors described two forms of pulmonary alveolar Microlithiasis- i) a form related to familial predisposition and ii) sporadic form that may be associated with other medical conditions such as long standing mitral stenosis, nephrolithiasis, milk alkali syndrome, pulmonary stenosis or desert lung syndrome [8-11].

Pathologically there is accumulation of calcified bodies in alveolar space 0.01-3mm in diameter. Chemical analysis and energy dispersion X-ray microanalysis have shown them to be composed of calcium and phosphate [2]. Pracyk et al estimated that the calco-spherites are composed of calcium and phosphate in a ratio of 2:1. In early phase alveolar wall appear normal but later interstitial fibrosis results in its thickening [12].

Clinical Presentation

Castellana's report describes this disease to affect both the sexes with a slight male predominance. The peak incidence is noted in second and third decades with gradual decrease thereafter. A few cases were reported in the pediatric patients as well (4). Most of patients are asymptomatic in the early phase (Fig 1). Cough and expectoration are uncommon. The predominant symptom that develops is dyspnea. As disease progresses Cor pulmonale with cyanosis and clubbing may set in. However the disease progression is variable. Even if microliths appear early lung deterioration is at different in different individuals. Environmental factors like cold and smoke also influences the progression.

Pneumothorax is also another presentation. The hall mark of disease is striking dissociation between the radiologic findings and the clinical features. According some authors certain environmental factors such as smoking, inflammation, cold temperature accelerate the turnover of epithelial cells and affects disease course and onset (13). Another observation is that male patients with PAM, infertility may be present due to genital apparatus Microlithiasis. Gross calcifications are also described in other organs like medullary calcification, gall stones, kidney stones and prostatic calcification.

Imaging spectrum

The usual radiological Investigations are radiography, CT chest and HRCT lung. Broncho-alveolar lavage (BAL), trans- bronchial biopsy and lung biopsy are other special tests done for the confirmation of diagnosis.

Chest radiograph shows diffuse bilateral calcific infiltrates predominantly in lower zones. This is sometimes described as snow-storm or sand-storm appearance. These infiltrates are alveolar and may show air-bronchogram. The opacities may be as numerous as to appear confluent, in which circumstances a normally exposed chest radiograph shows the lung as almost uniformly white often with total obliteration of mediastinal and diaphragmatic contour. Pleural calcification may be seen. The thickened appearance of pleura is observed which is only a visual effect produced by an exceptionally heavy concretion in sub-pleural parenchyma. Apical bullae are also seen. Felson first reported a linear radiolucency in the area of lateral pleura on chest radiograph and called it as 'black pleural line' (Fig 2) (14). Some believe that black pleural line is due to sub pleural cyst. Hoshino et al demonstrated that the black-pleural line on chest radiograph corresponded to the fat dense layer between rib and calcified parenchyma [15].

HRCT shows alveolar calcification, either micro nodular or ground glass type with posterobasal predominance. Calcification may be uniform or show some microscopic structure with accentuation along the pleural margin or fissures adjacent to inter lobar septae giving a polygonal appearance and bronchovascular bundle explaining the coarsely linear nodulation, reticulation and septal lines occasionally seen on chest radiograph and HRCT. A crazy paving pattern on chest HRCT with calcification along interlobular septae may be considered diagnostic, even pathognomonic of 3rd and 4th phase of PAM (16).

The radiological features may be divided into 4 evolutionary phases. First phase is *pre-calcific stage* where CXR may be normal or small no and lesser calcification of microliths. Second phase the CXR appear sandy. Uniform sized calcifications distributed throughout the lungs with greater concentration along medial and inferior margin. This stage the lungs appear like sand paper. The outline of diaphragm and cardia are still can be delineated. The third phase the calcifications increases appearing granular; nodular with thickening of interstitium (Fig 1, 2) Superimposition of calcifications will obscure the diaphragm and cardiac margin. In the fourth phase, size of calcifications further increase and interstitium also shows calcifications (Fig 3) and sometimes pleural calcifications appear as well. Lungs appear opaque and described as white lung (Fig 4). Korn et al reported thin walled sub-pleural cysts ranging from 5-10 mm in diameter on HRCT. Recurrent pneumothorax may also be seen due to sub-pleural cyst (Fig-3) [17]. Tuberculosis, Sarcoidosis and Pneumoconiosis including Stanosis should be considered in the differential diagnosis. The initial diagnosis is mainly done on chest X-ray, but the HRCT features are very characteristic.

Bronchial biopsy is the confirmatory investigation. There will be gradual deterioration ending in chronic pulmonary insufficiency secondary to interstitial fibrosis. In a few cases the disease may become arrested at an intermediate stage.

CONCLUSION

PAM is a rare disease with unknown etiology. Radiographs are pathognomonic of the condition. Striking discrepancy between the radiographic findings and clinical symptoms is very suggestive of PAM.

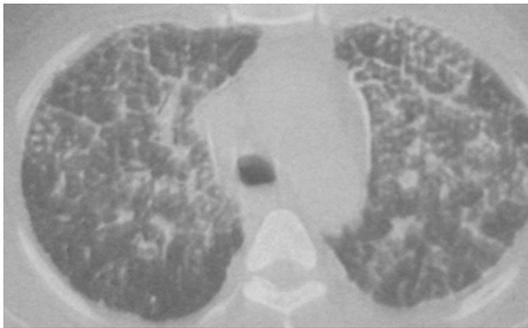


Figure-1: Cross-sectional image of lungs in an asymptomatic adult female of 45 years that reveals peripheral bullae with interlobular septal thickening giving polygonal appearance.



Figure-2: Calcification along the fissures with “black pleural sign” positive in a young Female of 25 years. The interstitium is thickened and calcified

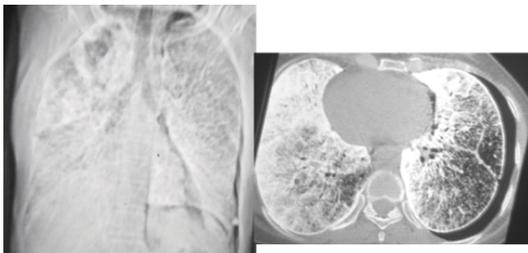


Figure-3: Sand storm appearance of lungs with left pneumothorax and obliteration of right Cardio-diaphragmatic out line in a middle aged woman ((48yrs). Apices are little spared as compared to rest of lung

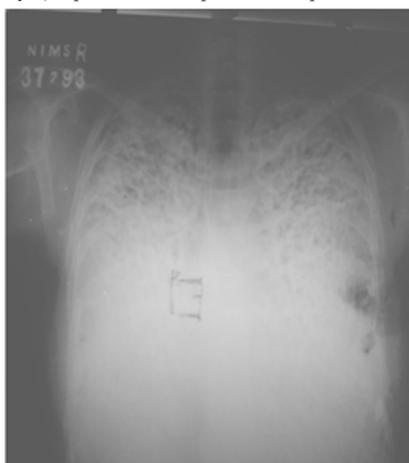


Figure-4: Young male presented with shortness of breath, CXR shows white out lungs.

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