

Case Report

Thoracic MDCT Findings of Two Cases with Pulmonary Alveolar Microlithiasis and Comorbid Presence of Thoracic Anterior Longitudinal Ligament Calcification

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Abstract: Pulmonary alveolar microlithiasis is a rare infiltrative disease of unknown etiology and pathogenesis; characterized by innumerable extensive micronodular calcifications in both lungs. In this article we present two cases with pathognomonic thorax Multi- detector row computed tomography (MDCT) findings and calcification of the thoracic anterior longitudinal ligament as an accompanying finding in our patients.

Keywords: Pulmonary alveolar microlithiasis, MDCT, Black pleura sign, Sandstorm, Thoracic anterior longitudinal ligament calcification.

INTRODUCTION

Pulmonary alveolar microlithiasis (PAM) is a chronic lung disease characterized by diffuse intraalveolar spheric accumulation of calcium and phosphate in both lungs and the patient may be asymptomatic until the alveolar gas exchange is affected, due to this; it can be diagnosed in adult age [1-6]. It was first reported by Friedrich in 1856 in an autopsy case. By Schildknecht radiological findings have been reported in 1932 and the following year it was named by Puhr [7]. There are pathognomonic findings of X-ray, HRCT and MDCT of PAM and the determination of these findings eliminates the need of histopathological diagnose [8-10]. The purpose of this study, is reviewing the MDCT findings of PAM in the literature and reporting two patients with comorbid presence of thoracic anterior ligament calcification.

CASE REPORT 1

29 years male patient with complaints of shortness of breath and dry mouth that continued increasing in last two years was admitted to the clinic of chest diseases. He had a history of smoking 1-2 packs a day for 10 years. There was no fever, chest pain or hemoptysis. There was no significant pathological finding in routine blood tests. In the pulmonary function tests moderate restrictive pulmonary disease findings were obtained. Arterial blood gas results were consistent with the findings of type 1 respiratory failure.

On PA chest x-ray, sandstorm appearance was seen which is caused by extensive distribution of

innumerable milimetric nodules in both lungs and typical for PAM.

On MDCT chest analysis: diffuse ground-glass opacity in both lungs, and a large number of calcific nodules superposed over them was seen. The extensive micronodular calcifications were particularly distributed peripheral and basilar, anterolateral in the lingula and middle lobe, anterior in the upper lobes (Fig. 1). There was (interlobular septal thickening in the lower lobes (Fig. 2: a,b). Subpleural cysts suggesting black pleura sign all along the pleura was noted (Fig. 3). Findings seen on CT scan were consistent with PAM. Results were especially obvious in mediastinal window and on MIP images (Fig. 4: a, b). Accompanying calcification of the anterior longitudinal ligament in thoracic vertebrae to all these lung findings was remarkable (Fig. 5).

The patient's other test results were as follows:

Grade I splenomegaly has been identified in the abdominal ultrasound examination. In the salivary gland biopsy for Sjögren's syndrome, preliminary diagnosis due to dry mouth symptom was reported as minor salivary gland, grade 0 (according to Chisholm and Mason classification). There was no diagnostic findings in terms of Sjögren's syndrome. The patient's biochemical results revealed no significant pathological findings. In serology tests CRP was 7.12 mg / l, C3: 2.11 g / l and C4: 0.901 g / l. Lupus anticoagulant verification test was positive.



Fig. 1: PA Chest radiography: pathognomonic finding caused by micronodular calcifications: 'sandstorm' appearance and obscured cardiac contours

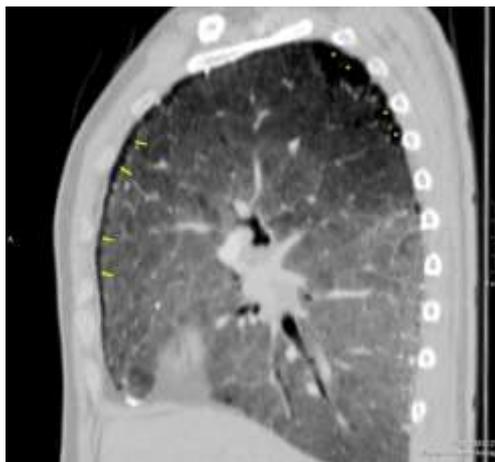


Fig. 3: Subpleural localized millimetric cysts which cause the 'black pleura' sign

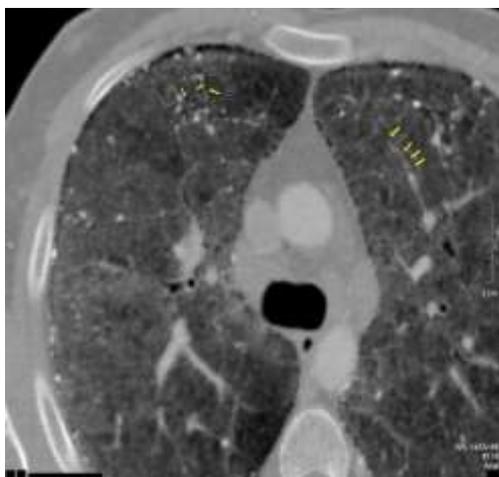


Fig. 2a: Millimetric-sized peribronchial cyst formations accompanied by interlobular septal thickening

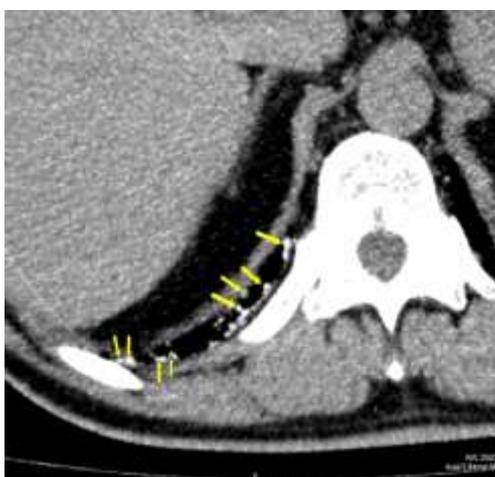


Fig. 4a: Axial CT scan: costal and diaphragmatic millimetric subpleural nodular calcifications at mediastinal window



Fig. 2b: Axial CT scan: calcified nodules that cause polygonal figure at the periphery of the secondary pulmonary lobule



Fig. 4b: MIP images: the microcalcifications are more obvious



Fig. 5: Calcification of the anterior longitudinal ligament in the upper thoracic levels

CASE REPORT 2

61-year-old male patient; was sent to our department for thorax CT examinations researching increased reticular densities in bilateral lower lung zones on PA chest X-ray; in the terms of interstitial lung disease (Fig. 6). On Thoracic CT examination: mostly pleural-based millimetric calcified opacities resulting micronodular appearance in the lower lobes of both lungs prominent in the dependant and peripheral surfaces were observed. Also ground-glass areas, peribronchial and septal thickening and examples of fine reticular appearance were present in the lower lobes (Fig. 7, 8). In the parenchyma adjacent to these locations; numerous millimetric calcified and noncalcified micronodules were present. In the right lower lobe there were focal consolidations beside the peribronchial thickening and acinary nodular infiltrates suggesting distal peripheral airway inflammation (Fig. 9). Results were considered significant primarily as alveolar microlithiasis.

Longitudinal anterior ligament calcification was present in the thoracic vertebrae.

There was no significant pathological findings in routine blood tests. In serology tests CRP was 14.1 mg/l

Due to the presence of pathognomonic radiological findings for PAM in both patients, lung biopsy was not required.



Fig. 6: In the second case; micronodular opacities in the both lower zones on chest X-ray

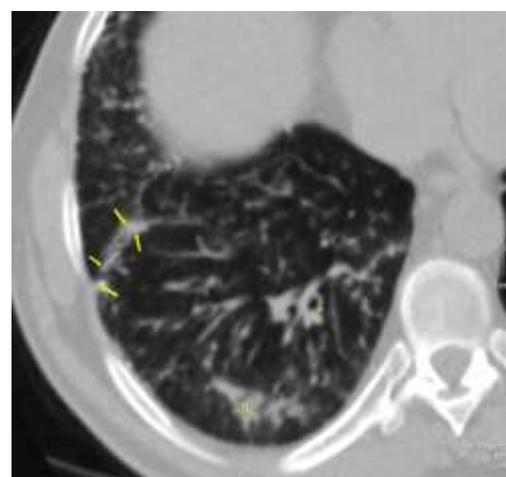


Fig. 7: On axial section- ground-glass opacities in the posterior segment of the lower lobe and focal consolidation (fc) calcific nodules accompanied by septal thickening in the lateral segment (arrows), peribronchial thickening (*)



Fig. 8: on Axial image- interlobular septal thickening and calcified nodules indicated with arrow marks in the anterior segment of the lower lobe of the left lung

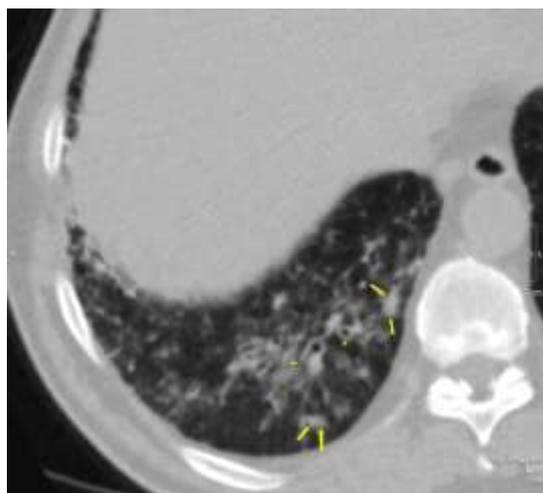


Fig. 9: on axial section- focal consolidation in the posterior segment of the lower lobe (arrow marks), with ground-glass attenuation (*) and peribronchial thickening

DISCUSSION

Pulmonary alveolar microlithiasis (PAM); is a rare disease of unknown etiology and pathogenesis; characterized by the diffuse intraalveolar spheric accumulation of calcium and phosphate in both lungs [1, 2, 8].

Although most of the microliths is derived from calcium and phosphate ; the calcium and phosphate metabolism is normal in most of the patients [11]. In recent years, the gene; SLC34A2 has been kept responsible for the disease [12]. In 2006, Corut *et al.* reported the discovery of several mutations in the gene encoding the type IIb sodium-phosphate cotransporter protein (SCL34A2) in individuals with PAM [13].

Considering all reported cases in the world there was no specific distribution of age range. Lopez reported two cases whom aged two years old and premature twins were reported by Caffrey *et al.* Until now, the oldest reported case was 72-year-old case reported by Barnard [14]. It has been reported that; in a group of patients with a family history; the frequency seen in women is much higher, whereas in sporadic cases; the frequency seen in male patients was higher. [1, 5].

The majority of patients has been reported from Asia, North America, Africa and Oceania countries followed by Europe. Most case reported countries are Turkey and Italy.

The major symptoms of the PAM cases involve dyspnea on exertion, cyanosis and clubbing. Respiratory failure and cor pulmonale occur in advanced stage [2, 3]. Pulmonary function tests indicate restrictive lung disease.

Calcified lung lesions have a wide spectrum of differential diagnosis that includes metastatic

calcifications and dystrophic calcifications. Lung calcifications can occur on many systemic disease e.g; chronic kidney disease, D hypervitaminosis, primary hyperparathyroidism. Since PAM has a pathognomonic radiological signs, generally the diagnosis can be made by radiologically and lung biopsy could not be required [8-10].

Histopathological diagnosis of the patients can be established by transbronchial biopsy, bronchoalveolar lavage and open lung biopsy. Macroscopically, lungs are very rigid and heavy due to calcified micronodules. Histopathologically, round calcified nodules (microliths) ranged 250-750 μ m in diameter is seen in alveolar spaces. Microliths have an onion-skin like concentric lamellar appearance [1, 2].

Radiologic Findings

Typically "sandstorm" pattern is seen predominantly in the lower zones and paracardiac zones of both lungs on plain chest radiographs. This pattern is caused by diffusely distributed small intraparenchymal nodules which are smaller than 1 mm and well-defined. It has been defined in the literature that in patients who had that pattern were not required lung biopsy [1, 2, 8].

In some patients, consolidation areas can be determined on chest radiograph due to that micronodules which obscure cardiac margins, diaphragma, cardiophrenic and costophrenic sinuses [3]. In cases with large consolidation areas, differential diagnosis includes pulmonary toxicity with amiodoron, metastatic pulmonary calcification, silicoproteinosis, talcosis and amyloidosis [15].

High resolution computed tomography (HRCT) is more sensitive than radiography for detecting the severity and extensity of the disease and for the clinical follow-up [2, 3]. On HRCT, in addition to micronodules; findings of subpleural nodules, nodular fissure, calcification along the interlobular septa, dense consolidations, paraseptal and centrilobular emphysema, subpleural cysts, black pleural lines, diffuse ground-glass attenuation areas, mosaic pattern and apical bullae can occur. End stage findings are seen mostly as diffuse interstitial involvement and mosaic pattern [16].

Glossary of HRCT findings seen in PAM has been described by the Brazilian College of Radiology and the Brazilian Thoracic Society [17, 18].

Small intraparenchymal nodules: round opacities smaller than 10 mm.

Consolidation: homogenously increased attenuation areas which obscures vascular structures and airways.

Ground-glass attenuation: lesser increase in the lung parenchym density so far as seen in consolidation; hence vessel and airway walls can be distinguished.

Mosaic pattern: is a mosaic design created by association of normally ventilated lung tissue and hyperlucent areas secondary to air-trapping accompanied by interlobular septal thickening in both lungs.

Calcification along the interlobular septa: thin linear opacities located periferally to the secondary pulmonary lobules visualised better when using mediastinal window.

Subpleural linear calcifications: juxtapleural linear opacities mostly visible on mediastinal window.

Subpleural cysts: hypodens structures less than 10 mm in diameter, next to pleura and fissure

Apical bullae: thin-walled, hypodens areas greater than 10 mm in diameter, seen in the lung apices.

The most common finding in PAM reported in the literature is ground glass attenuation [9,19, 20, 21].

In a study of Edson Marchiori *et al.*, it has reported that 90% of patients had subpleural linear calcifications [22].

Subpleural calcifications: caused by intraalveolar accumulation of calculi periferally to secondary pulmonary lobules and produce the apperance of pseudo-pleural calcification [20-25].

Findings of interlobular septal calcifications and interstitial involvement can occur in the inital phase of the disease [20, 26, 27].

When using the mediastinal window, calcifications along the interlobular septa can not be seen in any other disease, therefore it is considered pathognomonic [27]. Both patients we reported in that case report had that pathognomonic sign, thus the diagnosis of PAM was made by radiologically.

Extrapulmonary manifestations of PAM including medullary nephrocalcinosis, nephrolithiasis, testicular involvement, calcifications of seminal vesicle, epididym and periurethra have been reported in the literature [28, 29].

Both patients we reported had anterior longitudinal ligament calcification. In English literature, that finding accompanying PAM has not been reported previously.

A great number of medications including particularly corticosteroids and calcium-chelating agents have been tried but there is no spesific medical treatment . In this

context, bronchoalveolar lavage was performed in some cases for therapeutic purpose. Nevertheless, all of these options have not had significant benefit [30]. The benefit seen on some corticosteroids used cases, it was considered as a response to interstitial lung disease accompanying PAM [2]. On the other hand, disodium etidronate can be used in patients diagnosed in the inital phase of the disease. In literature, radiological regression followed by using disodium etidronate in pediatric patients diagnosed with PAM has been reported [8, 12, 31].

Lung transplantation is a treatment of choice for end-stage disease [2].

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