CHOKING ON SAND:

DIFFUSE CALCIFICATION OF THE LUNGS FROM PULMONARY ALVEOLAR MICROLITHIASIS

Summer Lepley DO, Mohamed Eslam MD, Kaitlin Phillips, Robin Rainey Kiehl, Blake Lesselroth MD
Department of Internal Medicine, University of Oklahoma-Tulsa

LEARNING OBJECTIVES

- Develop differential diagnosis for radiographic appearance of diffuse pulmonary calcification
- Explain the pathophysiology of pulmonary alveolar microlithiasis (PAM)
- Describe presenting characteristics, natural history, and treatment of PAM

INTRODUCTION

- Widespread pulmonary calcification is an uncommon finding in patients with dyspnea
- Pulmonary alveolar microlithiasis (PAM) is an extremely rare genetic disease
- Deposition of calcium phosphate microliths chokes the alveoli and small airways

CASE PRESENTATION

33yo Arab-Berber female from the Mediterranean presented to ER with acute on chronic dyspnea

- 10-year history of exertional dyspnea
- 2 days of acute, exertional and resting dyspnea
- Associated fever, pleurisy, and anxiety

Physical exam:

- 68% O2 sat on room air → 92% on 2L O2
- Tachypnea without accessory muscle usage
- Diffuse bronchial breath sounds
- Clubbing of digits

Initial diagnostics:

- Polycythemia, Hemoglobin 16.7
- Positive QuantiFERON gold test
- CXR: dense bilateral multilobar alveolar infiltrates; often described as "sandstorm" appearance
- CT Chest: Sub-total opacification of the lung parenchyma with calcific densities and superimposed air bronchograms

Inpatient evaluation:

- Bronchoscopy with bronchoalveolar lavage: scattered calcified concretions
- Negative blood and sputum cultures
- Negative fungal cultures
- Negative atypical respiratory panel
- Negative autoimmune workup

Disposition:

- Discussed lung transplant candidacy; patient refused work-up
- Discharged with supplemental oxygen
- Completed latent tuberculosis treatment
- Scheduled with interstitial lung disease specialist
- Lost to follow up after leaving United States

RADIOGRAPHIC FINDINGS

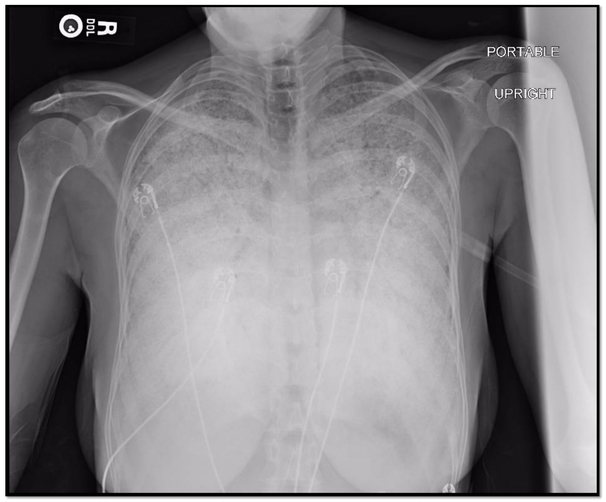

Figure 1: Diffuse "Sandstorm" lung appearance on Initial Chest X-Ray

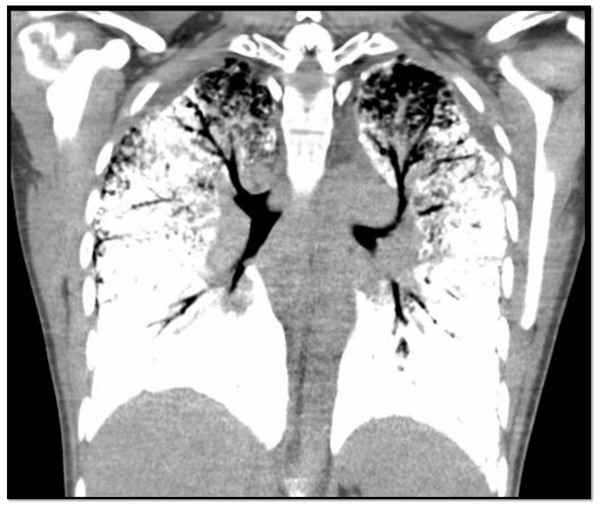

Figure 2: High Resolution Chest CT Coronal View

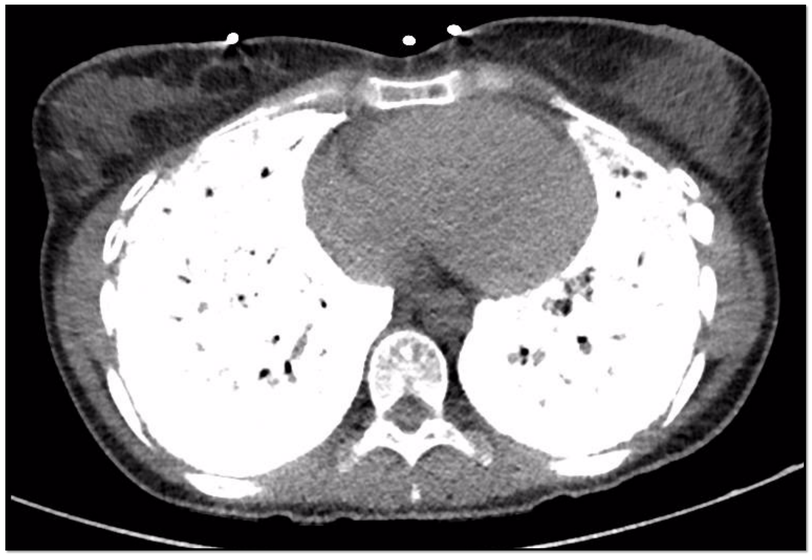

Figure 3: High Resolution Chest CT Axial View

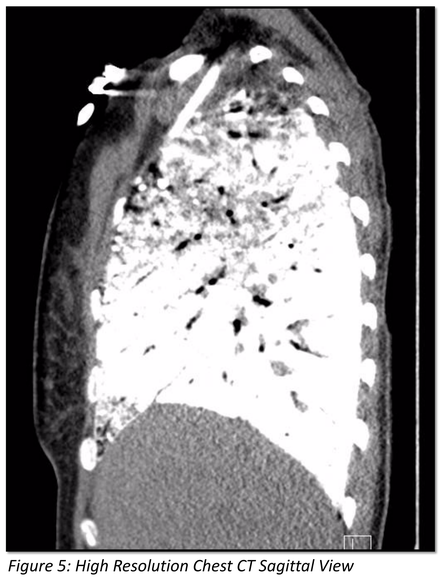

Figure 5: High Resolution Chest CT Sagittal View

BRONCHOSCOPY + BRONCHOALVEOLAR LAVAGE PATHOLOGY SLIDES

Calcified concentrations (large purple cells), pulmonary macrophages are the background cells (round, polygonal with a lot of cytoplasm) and a few bronchial epithelial cells

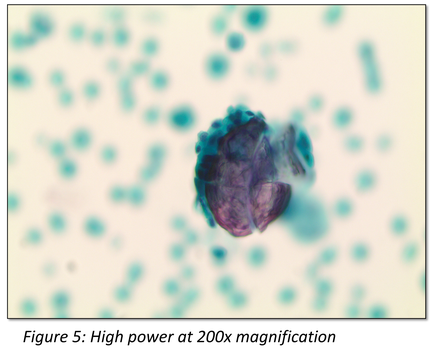

Figure 5: High power at 200x magnification

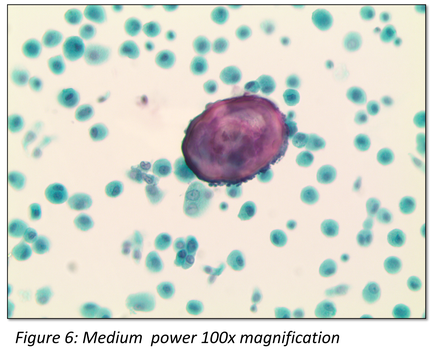

Figure 6: Medium power 100x magnification

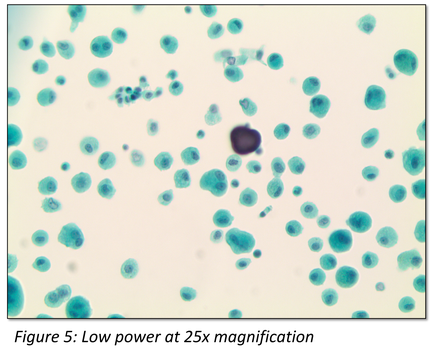

Figure 5: Low power at 25x magnification

CONCLUSION

Differential for diffuse alveolar calcific disease:

- Metastatic pulmonary calcification (i.e., calcium salt deposition in normal tissues as a function of systemic illness including end-stage renal disease)
- Dystrophic pulmonary calcification (i.e., calcification occurring in tissue damaged by infectious and non-infectious diseases including tuberculosis and sarcoid)
- Pulmonary alveolar microlithiasis (a genetic calcific disorder)

Pathophysiology of pulmonary alveolar microlithiasis:

- Rare genetic mutation of the SLC34A2 gene
- Abnormal type IIb sodium phosphate cotransporter in alveolar type II cells
- Dysfunctional cotransporter fails to clear phosphate from degraded surfactant
- Results in microlith accumulation, chronic inflammation, tissue destruction, pulmonary fibrosis, and respiratory failure. [2,3]

Characteristics and natural history:

- Most common in Asia
- Identified in 65 countries, but with highest prevalence in Turkey, Japan, and Italy
- Most patients are under 50y and approximately 35% present under the age of 20y
- Patients present with dyspnea (24%), nonproductive cough (14%), and chest pain (6%); severity ranges from asymptomatic to respiratory failure
- Diagnosis typically made with CT chest + bronchoscopy with bronchoalveolar lavage demonstrating intra-alveolar lamellar microliths
- Most progress to respiratory failure and cor pulmonale
- No established therapy for PAM; only definitive treatment is lung transplantation

The inpatient team and pulmonologist attributed presentation to progression of underlying chronic illness rather than a new or superimposed insult.

REFERENCES

1. Castellana G, Castellana G, Gentile M, Castellana R, Resta O. Pulmonary alveolar microlithiasis: review of the 1022 cases reported worldwide. Eur Respir Rev. 2015;24(138):607.
2. Lederer, E., & Wagner, C. A. (2019). Clinical aspects of the phosphate transporters NaPi-IIa and NaPi-IIb: mutations and disease associations. Pflugers Arch, 471(1), 137-148. 'doi:'10.1007/s00424-018-2246-5
3. Ferreira Francisco FA, Pereira e Silva JL, Hochhegger B, Zanetti G, Marchiori E. Pulmonary alveolar microlithiasis. State-of-the-art review. Respir Med. 2013;107(1):1.