June 2013 Imaging Case of the Month

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Clinical History

A 42-year-old woman complained of cough and intermittent wheezing with shortness of breath. Her previous medical history was unremarkable. Frontal and lateral (Figures 1A and B) chest radiography was performed.

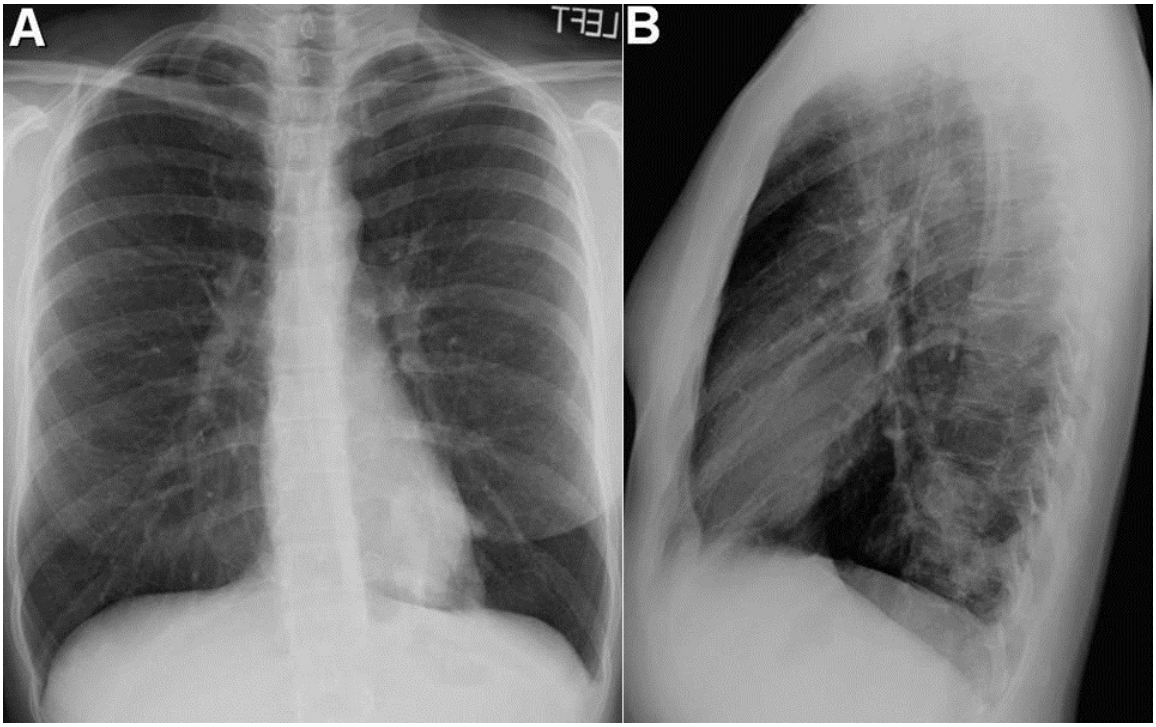

Figure 1. Frontal (Panel A) and lateral (Panel B) chest x-ray.

Which of the following statements regarding the chest radiograph is ***most accurate***?

1. The chest radiograph shows no abnormalities
2. The chest radiograph shows bilateral, basal reticulation suggesting fibrotic lung disease
3. The chest radiograph shows medial left lower lobe opacities
4. The chest radiograph shows large lung volumes associated with faint cystic change

5. The chest radiograph shows numerous small nodules suggesting a miliary pattern

Correct!

3. The chest radiograph shows medial left lower lobe opacities

The chest radiograph is abnormal, although the findings are somewhat difficult to appreciate on the frontal projection Figure 2A); they are more evident on the lateral projection (Figure 2B).

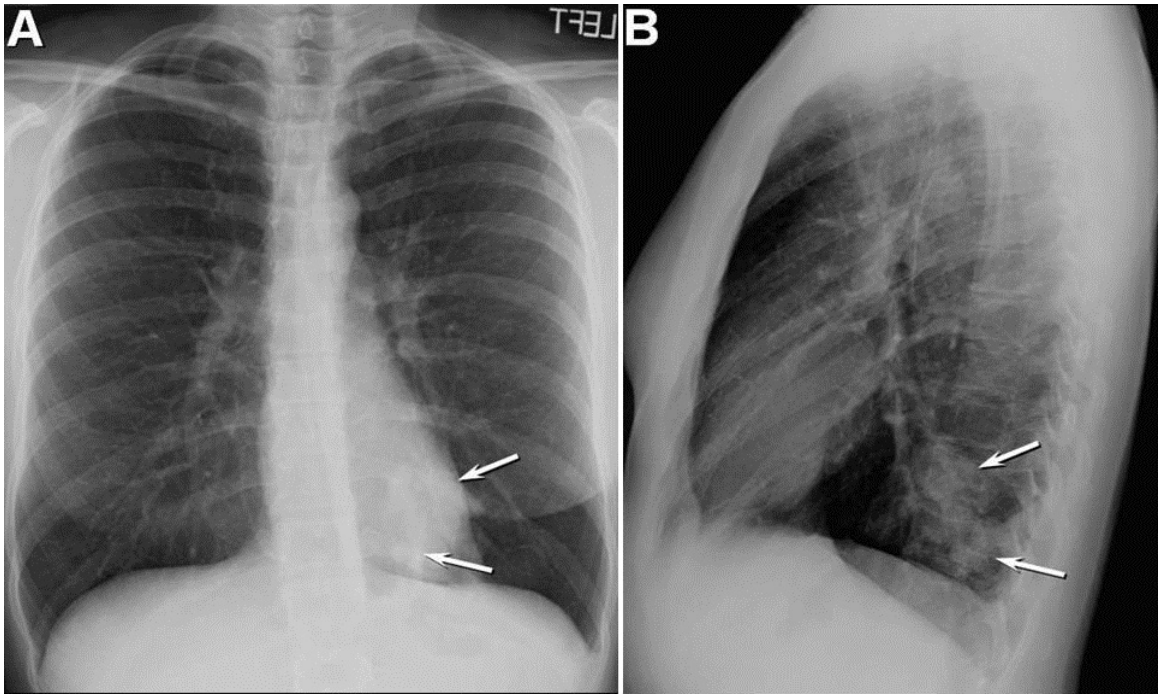

Figure 2. Chest radiography with abnormalities indicated by arrows.

There is no evidence of linear or reticular abnormalities to suggest a fibrotic process, and the lung volumes appear normal. No evidence of a miliary pattern is seen and no cystic changes are evident.

Which of the following provides the ***most accurate*** description / characterization of the morphology of the opacities present on the patient's presenting chest radiograph?

1. Cavitary
2. Consolidation
3. Nodular
4. Tubular
5. Reticular

Correct!
4. Tubular

The opacities in the medial left lower lobe on the chest radiograph show no evidence of internal lucency to suggest cavitation. The descriptive characteristics of consolidation on a chest radiograph- confluent or homogeneous, increased attenuation extending to the pleural surface, obscuring pulmonary vessels, associated with air bronchograms- do not accurately describe these opacities. The opacities are not nodular- they are not roughly uniformly spherical in all dimensions. The opacities do not conform to a “net-like” pattern; therefore, the term ‘reticulation” is not an apt descriptor for these findings. The opacities are, however, oblong- or tubular- in shape.

The patient underwent thoracic CT (Figure 3) for further characterization of the abnormalities seen at chest radiography.

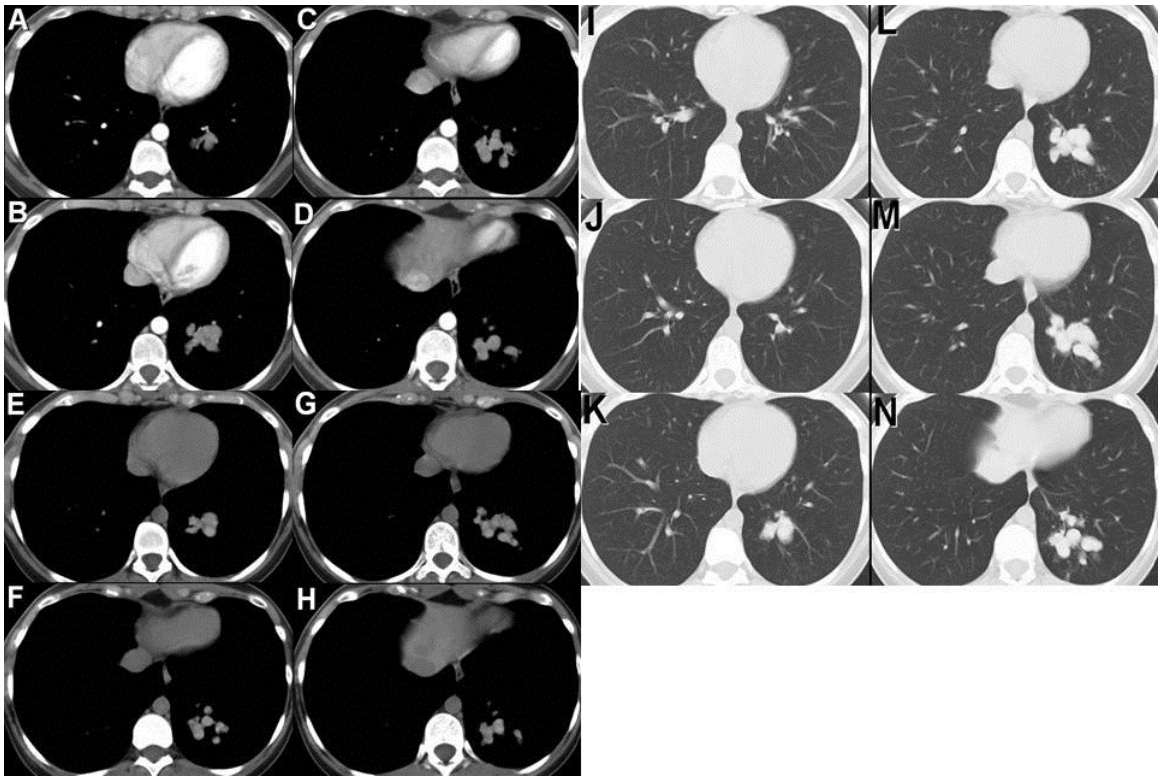

Figure 3. Enhanced (Panels A-D) and unenhanced (Panels E-H) thoracic CT displayed in soft tissue windows. Axial thoracic CT displayed in lung windows (Panels I-N).

Which of the following statements regarding this CT examination is ***most accurate***?

1. The thoracic CT shows focal left lower lobe consolidation
2. The thoracic CT shows impacted airways in the left lower lobe
3. The thoracic CT shows several arteriovenous malformations in the left lower lobe.
4. The thoracic CT shows cysts with air-fluid levels within the left lower lobe
5. The thoracic CT shows left lower lobe pulmonary artery aneurysms

Correct!
2. The thoracic CT shows impacted airways in the left lower lobe

The thoracic CT shows the tubular-shaped opacities within the left lower lobe. When a tubular shape is encountered at thoracic CT, two main diagnostic considerations present themselves- an abnormality involving an airway or an abnormality involving a vessel. In this case, a vascular etiology is excluded because the vessels in the left lower lobe show normal size. An arteriovenous malformation can only be diagnosed at thoracic CT when the artery leading to the vascular nidus, and the vein draining the nidus, are enlarged, and such is not the case here. Similarly the attenuation characteristics of the opacities on the soft tissue windows are not consistent with a vascular etiology, which excludes pulmonary artery aneurysm or varix. The tubular morphology is consistent with an airway etiology, and the absence of normal bronchi in the vicinity of the tubular opacities suggests that these opacities indeed represent impacted bronchi. There is no evidence of cystic disease or air-fluid levels in the left lower lobe, and, as reviewed previously, the imaging characteristics are not consistent with consolidation.

What is the ***appropriate next step*** for the evaluation / management of this patient?

1. Presumptive broad spectrum antibiotic treatment
2. ^{18F}FDG-PET scanning
3. Bronchoscopy with bronchoalveolar lavage and biopsy
4. Percutaneous transthoracic biopsy
5. Assessment of serum total IgE, skin testing for hypersensitivity to *Aspergillus fumigatus*, and complete blood count

Correct!
5. Assessment of serum total IgE, skin testing for hypersensitivity to *Aspergillus fumigatus*, and complete blood count

While active infection is not entirely excluded, the patient's clinical history and the imaging findings are not directly suggestive of infection. Imaging with ^{18F}FDG-PET scanning is unlikely to provide management-altering information- elevated tracer accumulation in the left lower lobe opacities would suggest and active inflammatory or neoplastic process, but lack of tracer accumulation would not provide an explanation for these opacities. Both bronchoscopy with bronchoalveolar lavage and biopsy and percutaneous transthoracic biopsy could provide a diagnosis for this patient, but may not be necessary, given that additional history and correlation with the CT findings may provide a presumptive diagnosis. Toward that end, evaluation of the complete blood count for possible peripheral eosinophilia, assessment of serum total IgE, skin and testing for hypersensitivity to *Aspergillus fumigatus* would prove useful before invasive measures are contemplated.

Based on the thoracic CT findings, additional history from the patient elicited asthma-like symptoms. The imaging findings of the various studies presented suggest ***which of the following diagnoses***?

1. Post-infectious bronchiectasis, likely related to prior viral infection or Pertussis
2. Cystic fibrosis
3. Primary ciliary dyskinesia
4. Allergic bronchopulmonary aspergillosis
5. Non-tuberculous mycobacterial infection

Correct!
4. Allergic bronchopulmonary aspergillosis

The tubular nature of the left lower lobe opacities is consistent with bronchiectasis and bronchial impaction. The hyperattenuating nature of the bronchial impaction is highly suggestive of *Aspergillus* infection, owing to that organism's ability to fix iron, calcium and manganese ions, which produces increased attenuation on thoracic CT. The focal nature of the bronchiectasis is somewhat peculiar for the diagnosis of allergic bronchopulmonary aspergillosis (ABPA), although focal ABPA presentations have been recognized. Cystic fibrosis is an unlikely diagnosis given the patient's history and the imaging findings- typically cystic fibrosis produces more widespread bronchiectasis, somewhat favoring the upper lobes, especially the right, and this distribution of abnormalities at thoracic CT is absent in this case. Post-infectious bronchiectasis, worldwide commonly caused by Pertussis and viral infections, such as measles, most often shows bilateral lower lobe predominance and is not typically focal in nature, and does not show a predilection for producing hyperattenuating bronchial impaction. Non-tuberculous mycobacterial infection causes several distinct appearances at thoracic CT, including a post-primary mycobacterial infection appearance (upper lobe consolidation, cavitation, nodules, and bronchiectasis) and the "Lady Windermere" syndrome (right middle lobe and lingular predominant bronchiectasis, consolidation, and nodules with tree-in-bud formation). The typical thoracic CT appearances and demographics associated with these presentations of non-tuberculous mycobacterial infection are absent in this case. Primary ciliary dyskinesia, or immotile cilia syndrome, is often associated with very widespread bronchiectasis and small airway impaction, and typical does not present with focal bronchiectasis. Additionally, small airway abnormalities consistent with bronchiolitis are often far more widespread in patients with primary ciliary dyskinesia than is seen in this case, and often the patient's history would be more suggestive of recurrent pulmonary infection and other abnormalities. Situs abnormalities are present in Kartagener syndrome, but the patient's situs is normal in his case.

The patient's total serum IgE level was elevated (1200 IU/mL), serum *Aspergillus fumigatus* precipitins and skin testing were positive, and peripheral eosinophilia was present. These features, in combination with the patient's clinical history and imaging findings, were considered consistent with ABPA. Due to the somewhat unusual focal nature of the disorder, bronchoscopy with bronchoalveolar lavage and transbronchial biopsy was performed, which revealed elevated IgE and eosinophils in the bronchoalveolar lavage fluid, and biopsy recovered airway infiltration by eosinophils, mucoid impaction, and *Aspergillus* organisms, confirming the diagnosis. No obstructing endobronchial lesion was seen.

Diagnosis: Allergic bronchopulmonary aspergillosis / Allergic bronchopulmonary mycosis

References

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