August 2017 Imaging Case of the Month

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Clinical History: A 67-year-old man with a 23 pack-year history of smoking, stopping 6 years earlier, presented with a year-long history of intermittent hemoptysis consisting of small specs of blood particularly in the morning after he awoke. No sputum discoloration was reported and the patient denied shortness of breath, fever, shortness of breath, and chills. The patient also denied rash, joint pain, and night sweats. His past surgical history was remarkable only for an appendectomy, tonsillectomy, and repair of an ankle fracture, all as a young man. The patient did report some asbestos exposure in the past. He takes a multivitamin and occasional over-the counter pain relievers, but was not taking prescription medications.

Physical examination: unremarkable and the patient's oxygen saturation was 98% on room air.

Laboratory evaluation: largely unremarkable. Quantiferon testing for *Mycobacterium tuberculosis* was negative. An outside otolaryngology examination was reported to show no abnormalities. Frontal chest radiography (Figure 1) was performed.

Figure 1. Frontal chest radiography.

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

1. The chest radiograph shows a mediastinal mass
2. The chest radiograph shows multifocal consolidation and pleural effusion
3. The chest radiograph shows multifocal smooth interlobular septal thickening
4. The chest radiograph shows a possible focal air space opacity
5. The chest radiograph shows small cavitary pulmonary nodules

Correct!

4. The chest radiograph shows a possible focal air space opacity

The frontal chest radiograph shows focal left lung opacity, consistent with air space opacity, with preservation of the left cardiac border. No lung nodules, cavitary or otherwise, are present. The cardiomeastinal contours appear normal. No evidence of interlobular septal thickening is seen. The opacity seen on the chest radiograph is focal, not multifocal, and no pleural effusion is present.

The patient underwent thoracic CT (Figure 2) for further investigation of the chest radiographic findings.

Figure 2. Axial thoracic CT performed several weeks after initial presentation, displayed in lung windows, shows patchy, multifocal ground-glass opacity (arrowheads) bilaterally, more pronounced on the right. In some areas the ground-glass opacity is faintly centrilobular in appearance (see insert). The findings are primarily distributed in the upper and mid lungs, with relative sparing of the bases (F). Relatively little left-sided lung opacity is seen, compared with the chest radiograph performed about 3 weeks earlier.

Which of the following represent **appropriate differential diagnostic considerations** for the chest radiographic pattern present?

1. Hypersensitivity pneumonitis
2. Lymphocytic interstitial pneumonia
3. *Pneumocystis jirovecii* pneumonia
4. Pulmonary hemorrhage
5. All of the above

Correct!
5. All of the above

The appearance of ground-glass opacity at thoracic CT is fairly non-specific, and any of the listed entities could produce the findings seen at CT. Often the differential diagnostic considerations for multifocal ground-glass opacity can be narrowed considerably when integrated with other findings at CT as well as certain clinical and laboratory data, but in the absence of such, the considerations for the thoracic CT findings is quite broad.

Which of the following represents **the most appropriate next step for the management** of this patient?

1. ^{133}Xe -Ventilation – $^{99\text{m}}\text{Tc}$ -perfusion scintigraphy
2. ^{18}F FDG-PET scan
3. ^{67}Ga -citrate scan
4. Bronchoscopy
5. Surgical lung biopsy

Correct!
4. Bronchoscopy

Bronchoscopy would be the best choice for further assessment to this patient. Surgical lung biopsy certainly could provide a diagnosis, and could subsequently play a role for the evaluation of this patient, but is premature at this point. ¹³³Xe-Ventilation – ^{99m}Tc-perfusion scintigraphy could provide some information regarding abnormal ventilation and differential pulmonary perfusion in the areas of infiltrative lung abnormalities, but it is unlikely that this procedure would contribute any useful information regarding the etiology of the lung opacities. ⁶⁷Ga-citrate scanning is now seldom used, only occasionally playing a role for the assessment of diffuse lung disease, which could be of some relevance to this patient, but, generally, the appearance of increased pulmonary tracer uptake at ⁶⁷Ga-citrate is non-specific. ¹⁸FDG-PET scanning is primarily employed for the assessment and staging of primary intrathoracic malignancy and metastatic disease as well as the evaluation of an indeterminate solitary pulmonary nodule, but increased tracer utilization in the lung parenchyma at ¹⁸FDG-PET in patients with diffuse opacities is also a relatively non-specific finding that does not reliably differentiate malignancy from benign etiologies, nor does it narrow the differential diagnostic considerations for these opacities.

The patient underwent bronchoscopy, carried out to the first subsegmental level, which showed normal anatomy on normal tracheobronchial mucosa. No secretions were seen. A few flecks of blood were detected at the orifice of the right upper lobe following bronchoalveolar lavage and few mucous plugs were found in the cloudy lavage fluid. A few bacteria were noted upon examination of the lavage fluid, for which the patient was started on broad-spectrum antibiotics.

Several days later the bacteria seen at bronchoalveolar lavage were identified as normal flora. Examination of the lavage fluid showed 10% neutrophils, 8% eosinophils, 2% lymphocytes, and 80% macrophages. Additional laboratory testing showed no elevated systemic inflammatory markers and renal and hepatic laboratory data were within normal limits. Equivocal elevation of the PR3-ANCA antibody (0.6; normal <0.4, equivocal, 0.4-0.9) and MPO-ANCA antibody (0.6; normal <0.4, equivocal, 0.4-0.9) were noted, but C- and P-ANCA antibodies were negative. The patient's anti-nuclear antibody level was weakly positive at 1.2 (normal, ≤1). Serum protein electrophoresis was normal, as was urinalysis.

Which of the following disorders is the **least likely** etiology for the diagnosis for this patient?

1. Chronic eosinophilic pneumonia
2. Eosinophilic granulomatosis with polyangiitis
3. Follicular bronchiolitis
4. Granulomatosis with polyangiitis
5. Microscopic polyangiitis

Correct!

1. Chronic eosinophilic pneumonia

Among the entities listed, chronic eosinophilic pneumonia is the least likely diagnosis as recent bronchoscopy failed to show significant pulmonary eosinophilia, which is practically always present in this disorder. Three of the entities listed- granulomatosis with polyangiitis, microscopic polyangiitis, and eosinophilic granulomatosis with polyangiitis- are vasculitides that may present with pulmonary hemorrhage, and are all appropriate considerations for the etiology of the lung disease in this patient, given the CT appearance and history of hemoptysis and blood demonstrated at bronchoalveolar lavage. Follicular bronchiolitis can present with areas of ground-glass opacity, including foci of centrilobular ground-glass nodules, at thoracic CT, and may occur in the context of connective tissue disorders; the latter is a consideration given the weakly positive anti-nuclear antibody test.

The patient returned for evaluation 3 months after presentation. He indicated he had not suffered any episodes of hemoptysis, and that he was doing well, exercising regularly. Review of systems revealed no complaints of shortness of breath, night sweats, or dyspnea on exertion. He did admit to a morning cough, which he attributed to night time reflux.

Repeat unenhanced thoracic CT (Figure 3) was performed.

Figure 3. Axial thoracic CT, performed 3 months after initial presentation, displayed in lung windows.

Which of the following statements regarding this imaging study is **most accurate**?

1. The unenhanced thoracic CT shows *improvement* in the ground-glass opacity
2. The unenhanced thoracic CT shows new cavitary lung nodules
3. The unenhanced thoracic CT shows new interlobular septal thickening
4. The unenhanced thoracic CT shows *stable* findings
5. The unenhanced thoracic CT shows *worsening* of the ground-glass opacity

Correct!

1. The unenhanced thoracic CT shows *improvement* in the ground-glass opacity

The repeat thoracic CT shows improvement in the multifocal ground-glass opacity seen on the thoracic CT performed near the time of presentation. No cavitory nodules are present, nor is new significant interlobular septal thickening seen.

The patient was begun on stomach acid-blocking therapy for presumed reflux, with the plan to have him return to clinic for repeat assessment in 6 months. Approximately 2 months later, the patient telephoned his physician, complaining of repeated hemoptysis, again with cough, but without dyspnea on exertion.

Which of the following represents the **next most appropriate** step for the evaluation of this patient?

1. Flexible fiberoptic bronchoscopy
2. Mediastinoscopy
3. Repeat thoracic CT
4. Thoracentesis
5. Thoracic MR

Correct!

1. Flexible fiberoptic bronchoscopy

Repeat flexible fiberoptic bronchoscopy is certainly a reasonable consideration for this patient at this point, but it may be prudent to first repeat the thoracic CT to determine if the lung opacities have worsened. It is possible that the CT could provide diagnostically useful information or, absent such, the CT could at least direct further procedures for tissue diagnosis. Thoracic MR is generally not rewarding for the study of diffuse pulmonary disease, particularly when a prior CT is available for comparison and the primary intent of repeat imaging is to assess for changes from the prior CT. Thoracentesis is not indicated given the absence of pleural effusion. Mediastinoscopy is generally reserved for patients with accessible mediastinal lymph node enlargement or masses, neither of which are present in this patient.

Unenhanced thoracic CT (Figure 4) was performed.

Figure 4. Axial thoracic CT displayed in lung windows, performed 2 months after Figure 2 and 5 months after initial presentation.

Which of the following statements regarding this imaging study is **most accurate**?

1. The unenhanced thoracic CT shows *improvement* in the previously noted ground-glass opacity
2. The unenhanced thoracic CT shows new cavitary lung nodules
3. The unenhanced thoracic CT shows new interlobular septal thickening
4. The unenhanced thoracic CT shows *stable* findings
5. The unenhanced thoracic CT shows *worsening* of the previously noted ground-glass opacity

Correct!

5. The unenhanced thoracic CT shows worsening of the previously noted ground-glass opacity

Repeat thoracic CT shows interval worsening of the previously noted multifocal ground-glass opacities, particularly focal in the right upper lobe. In some areas faint centrilobular nodules are present. No new cavitory lung nodules are clear interlobular septal thickening is seen.

Repeat PR3-ANCA and MPO-ANCA antibodies were negative.

Which of the following represents the **next most appropriate step** for the evaluation of this patient?

1. Cryobiopsy
2. Flexible fiberoptic bronchoscopy
3. Mediastinoscopy
4. Observation
5. Surgical lung biopsy

Correct!
5. Surgical lung biopsy

Repeat flexible fiberoptic bronchoscopy is reasonable, but given that this procedure did not yield a diagnosis previously, a more aggressive posture may be warranted. Therefore, either surgical lung biopsy or cryobiopsy are the best choices, favoring surgical lung biopsy given the larger tissue sample and, presumably, a greater likelihood of a definitive diagnosis, possible with this approach. As previously, mediastinoscopy is generally reserved for patients with accessible mediastinal lymph node enlargement or masses, neither of which are present in this patient. Given the already prolonged observation period and the failure of the process to remit with conservative therapy, observation is not a rewarding strategy for the further management of this patient.).

The patient underwent repeat bronchoscopy with instillation of a fiducial marker to direct subsequent surgical lung biopsy. A repeat thoracic CT was performed (Figure 5) to assist with navigational bronchoscopy and fiducial placement.

Figure 5. Axial thoracic CT displayed in lung windows performed for navigational bronchoscopy planning shows persistent, although slightly improved, multifocal ground-glass opacity (arrowheads), compared to the thoracic CT performed 5 months after presentation (Figure 4).

A video-assisted surgical lung biopsy was then performed. The material retrieved at this procedure (Figure 5) showed scattered particles of food / foreign material associated with airway-centered inflammation, organization, and airway-centered scarring, superimposed on a background of smoking-related changes. No evidence of malignancy or vasculitis was seen.

Figure 6. Representative photomicrographs of the lung biopsy. (A) At low power, patchy bronchiolocentric fibrosis is apparent with mild chronic inflammation. (B) At medium power, scattered fragments of foreign material (arrowheads) are embedded within the airway-centered scar. At high power, the fragments are amorphous, variably corrugated, and slightly refractile, consistent with old aspirated food particles, and are present (C) within the lumen of small airways and (D-E) in the peribronchiolar interstitium. Hematoxylin & eosin, original magnifications 40x (A), 200x (B), 400x (C-E).

Diagnosis: Aspiration of vegetable material

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