June 2014 Imaging Case of the Month

Michael B. Gotway, MD

Department of Radiology
Mayo Clinic Arizona
Scottsdale, AZ

Clinical History: A 63-year-old man with a history of early-stage Parkinson disease and coronary artery disease presented with a painful “lump” in the lower left neck. Frontal and lateral chest radiography (Figure 1) was performed.

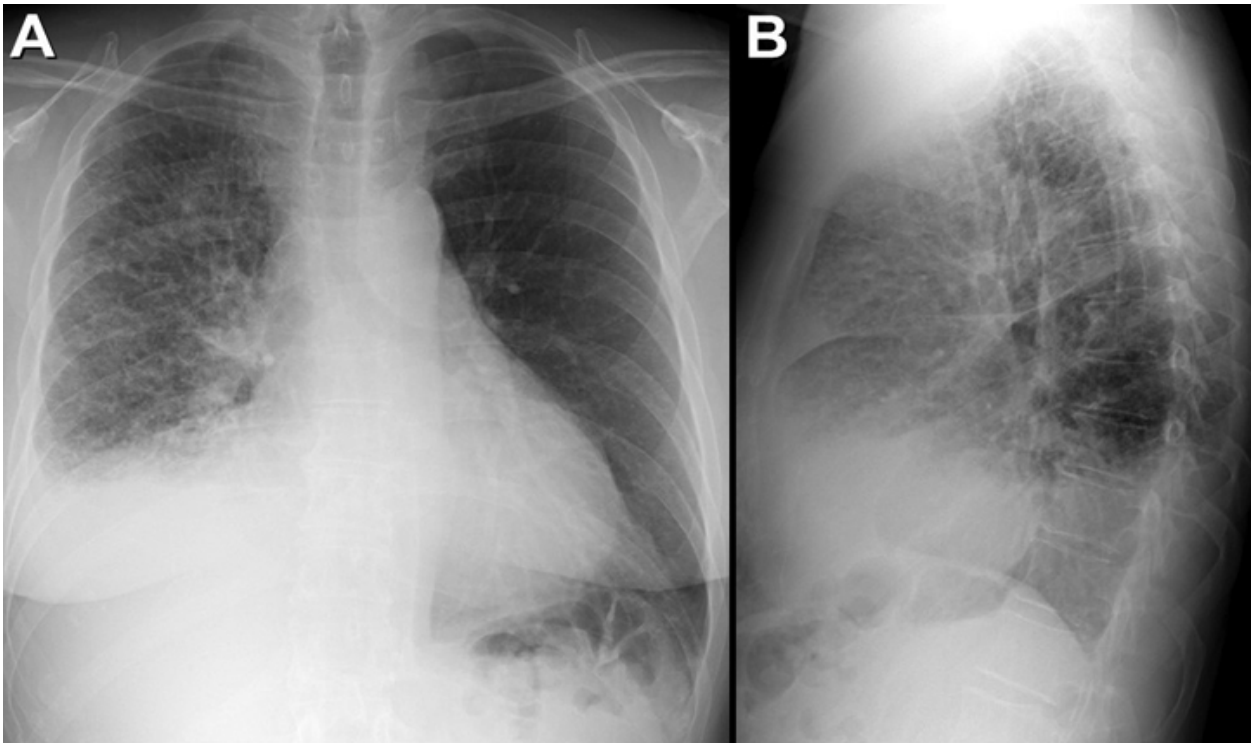

Figure 1. Frontal (panel A) and lateral (panel B) chest radiograph.

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 an asymmetric linear, interstitial pattern
3. The chest radiograph shows bilateral symmetric linear and reticular opacities
4. The chest radiograph shows multifocal, bilateral consolidation
5. The chest radiograph shows numerous small nodules

Correct!

2. The chest radiograph shows an asymmetric linear, interstitial pattern

The frontal chest radiograph shows a prominent linear pattern throughout the right lung, associated with a small-to-moderate right pleural effusion. No linear or reticular opacities are seen in the left lung. Consolidation is present in the right lower lobe, but the consolidation is not multifocal in distribution. The widening of the superior mediastinum is vascular in nature; no mediastinal mass is present. The opacities present in the right lung are linear in morphology; a nodular pattern is not evident.

Which of the following represents the next, ***most appropriate*** step for the assessment of the findings at chest radiography?

1. Obtaining prior thoracic imaging studies for comparison to determine if the lung findings are new or stable over time
2. Enhanced thoracic CT
3. 1 or 2
4. Thoracic MRI
5. Bilateral, frontal shallow (5°) oblique images to distinguish true lung infiltration from artifact or a chest wall lesion

Correct!

1. **Obtaining prior thoracic imaging studies for comparison to determine if the lung findings are new or stable over time**
2. **Enhanced thoracic CT**
3. **1 or 2**

Obtaining prior imaging studies is almost always the first priority when confronted with abnormal findings at chest radiography or thoracic CT. If one can show that abnormal findings are long-standing in nature, even if the etiology of the imaging abnormalities are uncertain, a conservative approach becomes possible, and the expense and potential for complications associated with more extensive evaluation may be avoided. Often, however, prior imaging studies have either not been performed or are unavailable, or, in some cases, the priors are not sufficiently old to assure that whatever imaging findings are present are innocuous. Furthermore, occasionally the patient's presentation requires timeliness which may not allow management to be postponed while awaiting comparison to prior imaging studies. In such cases, typically thoracic CT is required for further investigation. Therefore, choice "1" is correct, but choice "2" is also reasonable, and thus the best answer is choice "3"- but "1" or "2" are also correct. Thoracic MRI is not suitable for the evaluation of lung parenchymal abnormalities in general, and is certainly not as established as thoracic CT for this purpose. Bilateral frontal shallow oblique images are useful for the evaluation of focal pulmonary parenchymal opacities detected at chest radiography, but a generally not of value for the evaluation of extensive interstitial abnormalities.

Frontal chest radiography (Figure 2) performed 4 years earlier was located for comparison.

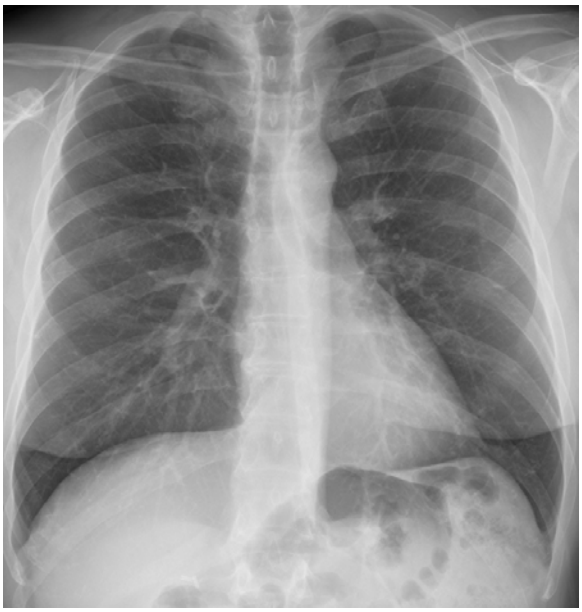

Figure 2. Frontal chest radiography performed 4 years prior to presentation chest radiography (Figure 1).

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

1. The frontal chest radiograph appears normal
2. The frontal chest radiograph shows a small right pleural effusion that enlarged at the time of the presentation chest radiograph
3. The frontal chest radiograph shows mediastinal and hilar lymph node enlargement
4. The frontal chest radiograph shows multifocal opacities of a different morphology and distribution than detected at the presentation chest radiograph
5. The frontal chest radiograph shows that the findings seen on the presentation study have been present previously

Correct!
1. The frontal chest radiograph appears normal

The frontal chest radiograph performed 4 years prior to Figure 1 appears normal. There is no evidence of lymph node enlargement of pleural abnormalities.

Enhanced thoracic CT (Figure 3) was performed for evaluation of the abnormalities detected at presentation chest radiography.

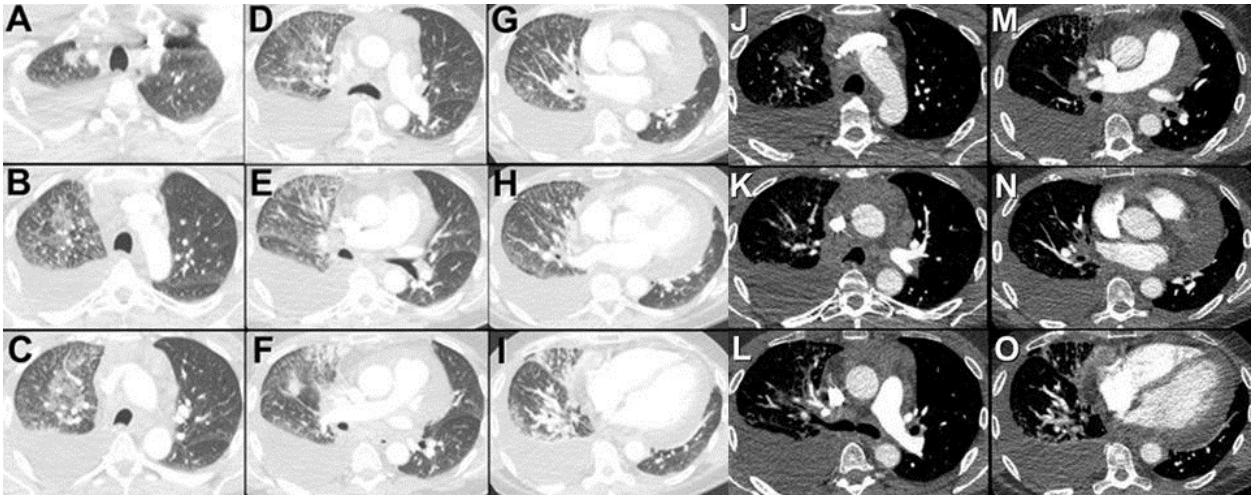

Figure 3. Representative static enhanced thoracic CT displayed in lung (A-I) and soft tissue (J-O) windows.

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

1. The thoracic CT shows interlobular septal thickening, pleural and pericardial effusions, and lung nodules
2. The thoracic CT shows non-septal linear opacities associated with architectural distortion, consistent with fibrotic lung disease
3. The thoracic CT shows numerous small nodules, consistent with a “miliary” pattern, as well as mediastinal lymph node enlargement and pleural effusion
4. The thoracic CT shows small perilymphatic nodules suggesting sarcoidosis
5. The thoracic CT shows unilateral linear opacities and traction bronchiectasis consistent with prior post-inflammatory scarring

Correct!

1. The thoracic CT shows interlobular septal thickening, pleural and pericardial effusions, and lung nodules

Thoracic CT shows a moderate-to-large right pleural effusion, a moderate pericardial effusion, mediastinal lymph node enlargement, right lung nodules, and multifocal, right-sided liner opacities representing interlobular septal thickening. There is no evidence of features suggesting fibrotic lung disease- such as architectural distortion, traction bronchiectasis, or honeycombing- to suggest either a fibrotic interstitial pneumonia or post-inflammatory scarring. While the interlobular septal thickening may appear slightly nodular in some areas, and larger right lung nodules are evident, a “miliary” pattern is not present. Importantly, no left lung nodules are seen, and a random dissemination pattern should show fairly diffuse, and certainly bilateral, abnormal findings. Perilymphatic nodules, often seen in patients with sarcoidosis, appear as small nodules along the central and peripheral bronchovascular interstitium as well as studding the visceral pleural surfaces; such a pattern in not evident on this CT scan.

A thoracic CT performed at an outside institution 3 months earlier (Figure 4) was obtained.

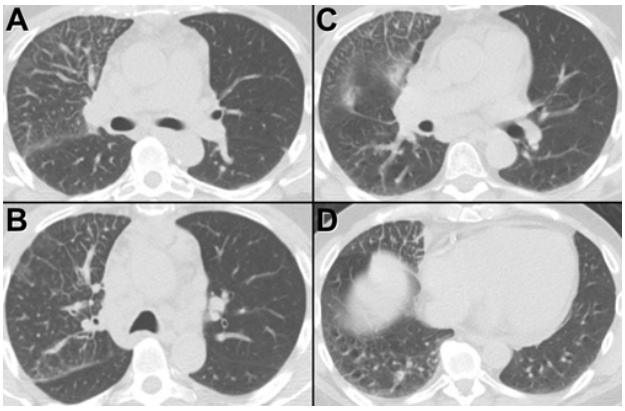

Figure 4. Representative axial thoracic CT displayed in lung windows performed 3 months prior to CT obtained at presentation.

This examination showed abnormalities similar to what was noted at the presentation thoracic CT (Figure 3), although these abnormalities were less pronounced. No tissue diagnosis was attempted at this time.

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

1. ^{18}FDG-PET scan
2. ^{68}Ga-citrate scan
3. Flexible fiberoptic bronchoscopy with transbronchial biopsy
4. Percutaneous transthoracic needle biopsy
5. Video-assisted thoracoscopic biopsy

Correct!
3. Flexible fiberoptic bronchoscopy with transbronchial biopsy

At this point, the patient has new clinical findings and new abnormalities on imaging that could represent an aggressive process, but without a clear context to allow presumptive treatment; therefore, a tissue diagnosis is warranted. Given the interstitial-appearing pulmonary abnormalities at thoracic CT, flexible fiberoptic bronchoscopy with transbronchial biopsy is the single best approach for obtaining a diagnosis. Video-assisted thoracoscopic surgery, open surgical biopsy, and, given the mediastinal lymph node enlargement, mediastinoscopy, all could readily obtain tissue for diagnosis as well, but are more invasive than bronchoscopy and should be reserved for use if bronchoscopy with transbronchial biopsy fails to obtain a diagnosis. ^{68}Ga-citrate scanning does not have a role in the evaluation of this patient. ^{18F}FDG-PET scan may also be performed, but the lack of tracer utilization would not provide useful information given the new and significant clinical symptoms and imaging abnormalities; similarly, increased tracer utilization at one or more of the abnormal sites on the patient's chest CT would be non-specific and still require a tissue diagnosis. The one circumstance in which ^{18F}FDG-PET scanning could prove useful for this patient's evaluation is if an unsuspected site of disease that is peripheral and easily percutaneously approach were found- biopsying this site could prove less expensive and potentially morbid than bronchoscopy.

Note that several possible methods that could be used to obtain a tissue diagnosis in this patient were not listed as possibilities- in particular, thoracentesis is a fairly simple procedure that could disclose a diagnosis and, even malignancy is found, provide staging information as well. Furthermore, the patient presented with a painful left supraclavicular lesion- this lesion could be imaged and, if approachable and appropriate, could be biopsied percutaneously.

^{18}FDG-PET scan was performed (Figure 5).

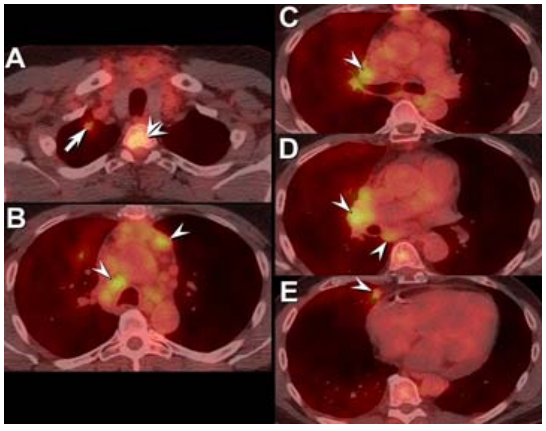

Figure 5. Axial ^{18}FDG-PET images show areas of intense hypermetabolism within hilar and mediastinal lymphadenopathy (arrowheads) and the cranial thoracic spine (double arrowheads). Mild hypermetabolism is present within an apical right lung nodule (arrow).

This examination shows active tracer uptake at many of the abnormal sites seen on the patient's thoracic CT, particularly the enlarged hilar and mediastinal lymph nodes. The ^{18}FDG-PET scan also showed thoracic spine hypermetabolic foci. Although the ^{18}FDG-PET scan did not disclose easily percutaneously accessible extrathoracic disease, hypermetabolic lower cervical and supraclavicular lymph nodes were detected, the latter correlating with the painful mass in the left supraclavicular region that caused the patient's presentation.

The hypermetabolic nodal mass in the left supraclavicular space was identified using ultrasound (Figure 6), and was biopsied under ultrasonographic guidance (Figure 6).

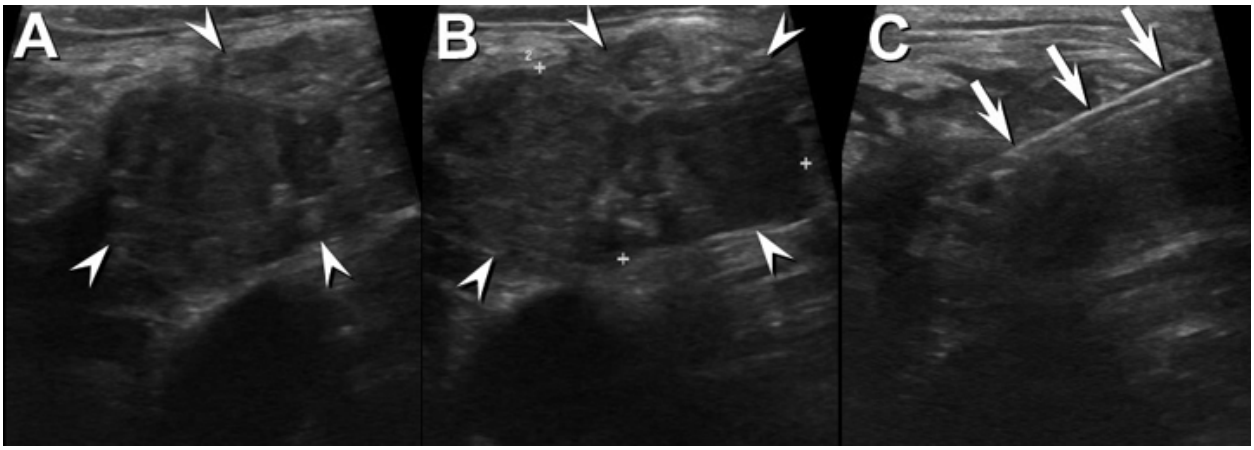

Figure 6. Transverse (A) and longitudinal (B) ultrasonographic images performed in the left base of neck, near the left supraclavicular region, shows a hypoechoic mass (arrowheads; also marked by calipers in [B]) correlating with the physical examination findings and ^{18}FDG-PET scan abnormalities. Ultrasound-guided percutaneous biopsy (C) of this mass was performed; note presence of needle (arrows) within the mass.

A diagnosis of metastatic lung adenocarcinoma was established.

Diagnosis: Pulmonary lymphangitic carcinomatosis due to lung carcinoma

References

1. Colby TV, Swensen SJ. Anatomic distribution and histopathologic patterns in diffuse lung disease: correlation with HRCT. J Thorac Imaging. 1996;11(1):1-26. Erratum in: J Thorac Imaging 1996; 11(2):163. [CrossRef] [PubMed]
2. Prakash P, Kalra MK, Sharma A, Shepard JA, Digumarthy SR. FDG PET/CT in assessment of pulmonary lymphangitic carcinomatosis. AJR Am J Roentgenol 2010; 194(1):231-236. [CrossRef] [PubMed]
3. Gruden JF, Webb WR, Naidich DP, McGuinness G. Multinodular disease: anatomic localization at thin-section CT--multireader evaluation of a simple algorithm. Radiology 1999; 210(3):711-720. [CrossRef] [PubMed]
4. Nishino M, Itoh H, Hatabu H. A practical approach to high-resolution CT of diffuse lung disease. Eur J Radiol 2014; 83(1):6-19. [CrossRef] [PubMed]