CHEST

A 76-Year-Old Man With a 75 Pack-Year History of Smoking and a Pulmonary Nodule

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VIDEO

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A 76-year-old man with a 75 pack-year history of smoking presented to the pulmonary clinic for evaluation of a right upper lobe 1.4-cm spiculated peripheral pulmonary nodule that was incidentally detected on CT of the chest (Fig 1). PET-CT of the nodule prior to presentation showed avidity at the nodule with a standardized uptake value of 1.55 but no evidence of other metastatic foci.

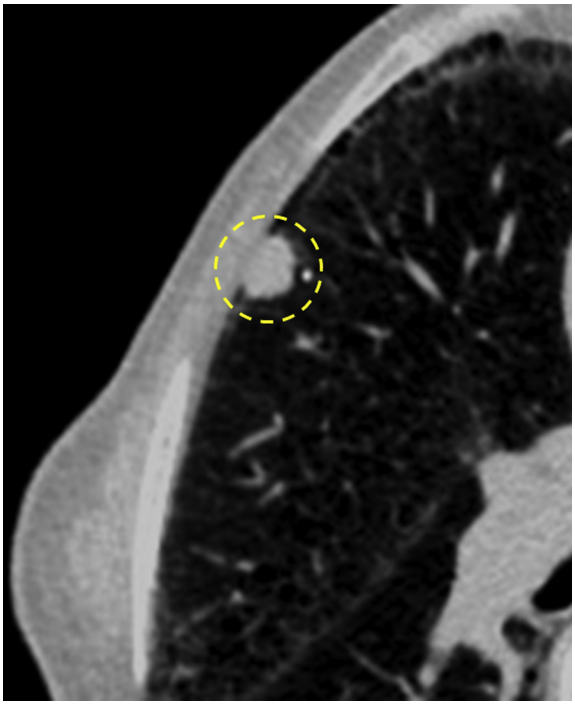

Figure 1 – *CT of the chest with right upper lobe peripheral pulmonary nodule (yellow hatched circle). Image reproduced with the patient's permission.*

Question: How could the patient's nodule be further characterized at the bedside?

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Answer: Bedside ultrasonography can be used to assess peripheral- and pleura-based pulmonary lesions and for transthoracic ultrasonographically-guided biopsy with 3-D ultrasonography to further characterize the peripheral pulmonary lesion.

Subsequent clinical course: The nodule abutted the pleura allowing for ultrasonographic imaging (Video 1). The nodule was imaged in multiple planes and during breath-holding using a free-hand technique and a Phillips CX50 ultrasound unit with a 12-3 MHz linear transducer for further characterization of volume and shape. Furthermore, a data set was obtained for 3-D reconstruction of the nodule (Fig 2). Ultrasonographically-guided transthoracic needle aspiration (TTNA) was performed in the pulmonary clinic followed by mediastinal staging with endobronchial ultrasonographically-guided transbronchial needle aspiration, and the patient was diagnosed with stage Ib adenocarcinoma of the lung (Fig 3, Video 2). Immediately following the biopsy, ultrasonography of the chest was performed to ensure that adequate lung sliding was present and that there was no evidence of pneumothorax.

Discussion

The use of 2-dimensional (2-D) ultrasonography in the evaluation of pleural-based lesions and pulmonary nodules abutting the pleura is well described in the literature.[1] 2-D ultrasonography is useful for facilitating TTNA of pleura-based lesions and nodules that abut the pleura. It can be used to identify the boundaries of a lesion and during breath-holding can be used to facilitate biopsy procedures. After a biopsy, it can be used to assess for adequate lung sliding to rule out pneumothorax. 2-D imaging is, however, limited by a single image plane that can be difficult to localize and replicate for follow-up imaging. Furthermore, 2-D imaging has limitations regarding accurately tracking nodule morphologic characteristics and volume.[2] Although the clinical applications of 3-D ultrasonography are being recognized in many organs of the human body, 3-D ultrasonographic reconstruction of peripheral lung lesions have not been described previously.

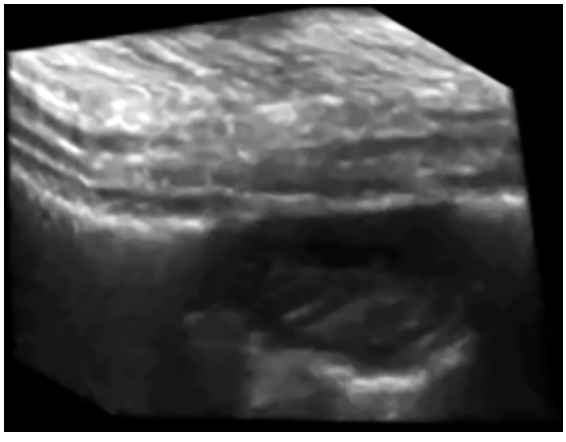

Figure 2 – *3-D ultrasonographic image of peripheral lung nodule obtained with a Philips CX-50 and 12-3mHz linear transducer. Image reproduced with the patient's permission.*

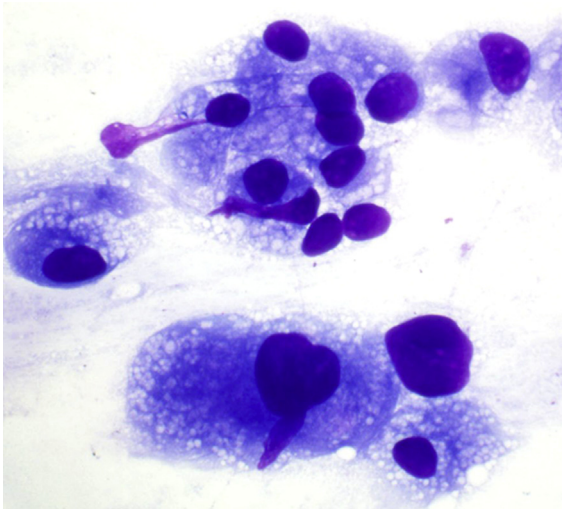

Figure 3 – *Histologic appearance of peripheral lung nodule with classic adenocarcinoma pattern. Image reproduced with the patient's permission.*

3-D ultrasonography has shown utility in cardiac, gynecologic, urologic, and breast imaging.[3] It is an emerging modality for characterization of liver metastasis as well as renal lesions. The use of 3-D ultrasonography has demonstrated clinical utility in volumetric assessment of a number of malignant lesions and has been used to improve biopsy yield for certain solid organ tumors. These organs provide excellent acoustic windows that favor ultrasonography as an imaging modality. The lungs, as air-filled organs in their healthy state, provide poor acoustic windows, with the exception of the pleura and opacities that abut the pleura. The ultrasonographic appearance of peripheral pulmonary nodules and masses has been well described. Until now, 3-D ultrasonography has not been used to characterize pulmonary nodules.