Case Report

Role of radial endobronchial ultrasound-guided transbronchial needle aspiration in the diagnosis of pulmonary nodules: Case report and literature review

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ABSTRACT

The diagnosis of pulmonary nodules can be made using several methods including computed tomography (CT)-guided fine-needle aspiration (FNA), radial endobronchial ultrasound (EBUS)-guided sampling techniques (transbronchial lung biopsy [TBLB], transbronchial brush, bronchoalveolar lavage, or transbronchial needle aspiration [TBNA]), or occasionally with convex probe (CP) EBUS-TBNA. While CT-guided FNA is associated with a high (25%) rate of pneumothorax, the CP-EBUS cannot reach lesions beyond the interlobar region. Radial EBUS-guided TBLB and transbronchial brushing are excellent modalities in the evaluation of peripheral pulmonary lesions. However, these techniques cannot access lesions that are located adjacent to the proximal segmental bronchus, due to the presence of a cartilaginous wall. Herein, we describe a 58-year-old man, who presented with a lung nodule in the right middle lobe, wherein radial EBUS-guided TBNA proved to be the most appropriate diagnostic modality. We also discuss the current utility of radial EBUS-guided TBNA in day-to-day practice.

KEY WORDS: Endobronchial ultrasound, guide sheath, lung cancer, transbronchial needle aspiration

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INTRODUCTION

The sampling of lung nodules or masses located close to the hilum is a peculiar problem. Before 1992, conventional transbronchial needle aspiration (TBNA) was the only bronchoscopic method available for accessing lesions in the lung parenchyma that were too central for a transbronchial lung biopsy (TBLB).[1-3] Moreover, only those lesions that were adjacent to the airways or that could be identified during fluoroscopy were amenable for TBNA. The subsequent introduction of radial endobronchial ultrasound (EBUS) revolutionized the diagnosis of intraparenchymal pulmonary lesions.[4-6] Apart from guiding transbronchial brushings and biopsies, the radial probe EBUS was also used for performing TBNA from lesions located adjacent to the airways.[5,7] However, the major drawback was that the procedure was not performed in real-time.

The introduction of convex probe EBUS (CP-EBUS) transformed the sampling of lesions located adjacent to the proximal airways as these could be accessed under real-time ultrasound guidance, thereby greatly increasing the diagnostic yield.[8,9] In fact, the CP-EBUS has replaced radial EBUS-guided TBNA not only for mediastinal lesions but also for lung masses, in contact with major airways or esophagus.[10,11] Currently, the radial EBUS is used primarily

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for accessing peripheral pulmonary lesions (PPLs), with the help of TBLB, bronchial brushing and bronchoalveolar lavage (BAL).[12] Although PPLs can also be accessed with the help of transthoracic ultrasound or computed tomography (CT)-guided fine needle aspiration (FNA), there is a significant risk of pneumothorax (about 25%).[13]

Herein, we describe a patient in whom radial EBUS-guided TBNA turned out to be the most suitable technique for accessing a lung lesion located adjacent to the proximal airway. We also review the current concepts of TBNA performed during the radial EBUS procedure.

CASE REPORT

A 58-year-old man presented with a complaint of headache of 2-month duration. There was no history of fever, vomiting, altered sensorium, or neurological deficit. The patient complained of breathlessness on exertion, but there were no symptoms of cough, chest pain, or hemoptysis. The patient was a smoker with a smoking history of 20 pack years. Auscultation of the chest revealed decreased breath sounds over the right upper lobe area. Laboratory investigations revealed anemia (hemoglobin, 9.2 g/dL) and hypoalbuminemia (albumin, 3.1 g/dL). Magnetic resonance imaging of the brain showed the presence of multiple space occupying lesions. CT of the thorax showed a large bulla in the right upper lobe and emphysema in both the lung fields. A spiculated nodule measuring 2.8 cm × 2.7 cm was seen in the right middle lobe, about 1.5 cm away from the hilum [Figure 1a and b].

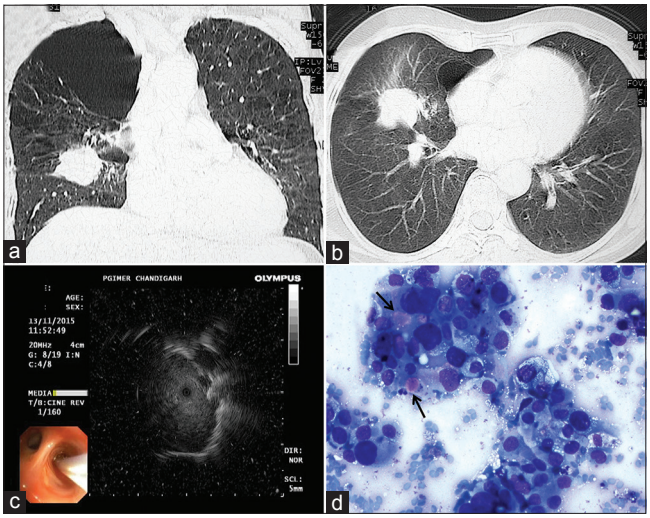

Figure 1: Computed tomography chest showing a spiculated nodule in the middle lobe of the right lung (a, coronal section; b, axial section). The nodule is surrounded by lung parenchyma on all sides and is away from the hilum. Radial ultrasound image (c) showing the lung nodule along with the placement of the radial probe in the lateral segment of the right middle lobe (inset). (d) A cluster of tumor cells showing moderate nuclear pleomorphism, round nuclei, coarse chromatin, occasional prominent nucleoli and moderate amount of vacuolated cytoplasm with intracytoplasmic mucin (arrows, MGG, ×40)

Flexible bronchoscopy (BF-P180, Olympus, Japan; external diameter 4.9 mm, channel size 2.0 mm) was performed in the supine position under conscious sedation (midazolam and pentazocine) and topical anesthesia.[14] Airway inspection revealed no abnormalities. The flexible bronchoscope was removed, and CP-EBUS bronchoscope (BF-UC-180F, external diameter 6.9 mm, Olympus, Japan) was inserted for sampling the lesion. However, the CP-EBUS scope could not be negotiated into the middle lobe. Subsequently, the radial EBUS probe (UM-S20-17S radial ultrasound probe, Olympus Japan; 1.4 mm distal end diameter, 20 MHz operating frequency) placed in a guide sheath (K-201, outer diameter 1.95 mm, Olympus, Japan) was used for localizing the nodule.[15] The lesion was visualized adjacent to the lateral segment of the right middle lobe at the very proximal end of the segmental bronchus. The radial probe was removed, and TBNA was performed using a 21-G needle (Smooth Shot, NA-401D 1321; minimal channel size required 2 mm, Olympus, Japan) at the visually chosen site under endoscopic vision [Figure 1c]. The needle was moved to and fro 10–15 times within the mass. Three passes were obtained from the same site, and the aspirate was submitted for cytological examination.[16] Brush cytology and TBLB were considered inappropriate due to the proximal location of the nodule.

Cytological examination revealed clusters of tumor cells with intracytoplasmic mucin suggestive of adenocarcinoma [Figure 1d]. The patient was administered dexamethasone and phenytoin in view of the brain metastases. He was planned for palliative radiotherapy and single agent chemotherapy in view of his poor performance status (Karnofsky Performance Score 60). However, the patient developed recurrent seizures and succumbed to his illness.

DISCUSSION

The present case illustrates the utility of radial EBUS-guided TBNA in the era of CP EBUS-TBNA. The index patient had a solitary pulmonary nodule located about 2 cm from the hilum. The nodule was localized at the proximal part of the lateral segment of the right middle lobe. We were unable to negotiate the CP-EBUS to the segmental bronchus of the middle lobe as the diameter of the EBUS scope is 6.9 mm. In the near future, an EBUS scope with a smaller diameter (5.9 mm) may allow real-time access of intrapulmonary lesions surrounding the segmental bronchi.[17] CT-guided FNA would have entailed a high risk of pneumothorax in view of the extensive emphysema.[13] Therefore, a radial EBUS-guided sampling was judged to be the safest and the most appropriate method.

Among the sampling techniques performed with a radial EBUS probe, TBLB and brushing would have a very low likelihood of yielding a diagnosis in this patient as the biopsy forceps or the brush cannot pierce the cartilaginous proximal bronchi and reach the lesion lying underneath the wall. Moreover, the bronchial cartilage was not involved,

as evident from the radial EBUS images, thus reducing the chance of finding malignant cells on bronchial brushings. A BAL would also be unlikely to yield a diagnosis in the presence of a discrete nodule. We could not perform a TBNA through the radial probe guide sheath, a method that has been recently described.[18] This is because, we used a smaller caliber guide sheath through which a 21-G TBNA needle (that requires a minimum channel size of 2 mm) could not be inserted. Thus, a conventional TBNA at the site of the lesion visually chosen with the help of the radial EBUS probe was considered the most appropriate procedure. Alternatively, a needle brush, which combines a bronchial brush with a needle could also have been employed to access the nodule.[19] As compared to TBNA without a brush, this technique would have provided an additional specimen for cytological examination.

Before the advent of the CP-EBUS, radial EBUS-guided TBNA was routinely used for localizing lesions adjacent to the airways (located both in the mediastinum and in the lung parenchyma), which were then sampled with the conventional TBNA needle.[5,20] With the advent of the CP-EBUS probe, the radial EBUS is no longer utilized for accessing airway-adjacent lesions (including the mediastinum and the lung hilum, up to the interlobar region). In fact, the radial EBUS-guided TBNA is not commonly employed for lesions located within the lung parenchyma also, despite the presence of evidence for its efficacy.[21] In a recent report of 581 patients in the ACCP Quality Improvement Registry, Evaluation and Education registry that described the performance of bronchoscopy for PPLs, only 47 patients underwent a TBNA guided by radial EBUS.[22]

Two recent studies have described the performance of radial EBUS-guided TBNA using a guide sheath in certain specific circumstances.[6,18] On several occasions while performing radial EBUS, the probe cannot reach the center of the lesion; the lesion is thus visualized eccentrically on one side of the probe, rather than concentrically around the probe. The yield of EBUS is significantly less when the probe does not reach the center of the lesion as compared to the situation when it does. Takai *et al*. have emphasized on the efficacy and safety of radial EBUS-guided TBNA technique for lesions where the radial probe is seen "outside" the lesion rather than "within."[18] In another retrospective study, Hayama *et al*. have described the use of fluoroscopy-guided TBNA for lesions, which were not visualized by the radial EBUS probe.[6] Interestingly, the lesions that were not initially visible with radial EBUS became visible after performing the TBNA procedure. The authors attribute this to the phenomenon of the TBNA needle cutting open a passage through which the probe, when subsequently reinserted, can reach the lesion. Brushings and forceps biopsies can then be performed, thereby, increasing the diagnostic yield.[6]

What is the current place of TBNA in radial EBUS-guided sampling? In our opinion, radial EBUS-guided TBNA should be routinely performed in sampling PPLs as it has been shown to significantly increase the diagnostic yield when added to EBUS-guided conventional diagnostic procedures (TBLB, brushings, BAL).[21] In the absence of smaller diameter CP-EBUS, the radial EBUS-guided TBNA currently remains the best technique for accessing intrapulmonary lesions surrounding the segmental bronchi, as demonstrated in the index case. Finally, it is an important technique for especially enhancing the yield of radial EBUS for PPLs where the radial probe is seen "outside" the lesion rather than "within,"[18] or in situations where the PPL is not initially visualized on radial EBUS.[6]

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Conflicts of interest
There are no conflicts of interest.

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