Curvilinear Probe Endobronchial Ultrasound for Sampling of Parenchymal Lung Lesions

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Abstract

Lung cancer is the leading cause of cancer related deaths in most countries. It can frequently be mimicked by other nonmalignant pulmonary lesions; and therefore, in the case of radiologically localized lesions a pathological diagnosis is preferable before proceeding to surgical resection. Curvilinear probe endobronchial ultrasound is widely used to sample lymph nodes, but in this case, we report that it can be beneficial for sampling parenchymal lung lesions not accessible at bronchoscopy in the absence of lymphadenopathy.

Keywords: Endobronchial ultrasound, lung cancer, lymphadenopathy

INTRODUCTION

Lung cancer is the leading cause of cancer death worldwide accounting for an estimated 1.37 million deaths/year. The prognosis in lung cancer is poor, with >80% of patients presenting with incurable disease and 5-year survival across all stages <15%.¹ Curvilinear endobronchial ultrasound (EBUS) plays a key role in the staging of the mediastinum. However, the role of curvilinear EBUS in the evaluation of parenchymal lesions, inaccessible at flexible bronchoscopy, is less well established. We report the use of EBUS at the Interventional Bronchoscopy Unit at Galway University Hospital for the successful diagnosis of cancer in a patient with an apical right lower lobe parenchymal lesion where flexible bronchoscopy failed to yield a diagnosis.

CASE REPORT

A 67-year-old male smoker with a 35 pack year smoking history was reviewed in the rapid access lung clinic following an episode of hemoptysis. Pulmonary function tests showed an obstructive pattern with a forced expiratory volume in one (FEV1) postbronchodilator of 1.55 (58%) and a forced vital capacity (FVC) of 3.87 (113%). The FEV1/FVC ratio was 40%. A chest radiograph demonstrated lung hyperinflation. The patient underwent further assessment with volumetric computed tomography (CT) scan with contrast of the thorax. This revealed a 1.1 cm × 1.2 cm lesion posterior to the bronchus intermedius in the apical subsegment of the right lower lobe, on a background of paraseptal emphysema [Figure 1a]. No CT enlarged mediastinal lymph nodes were identified. A careful comparison to a previous scan performed 2 years previous identified a lesion at the same location that measured 0.6 cm × 1.0 cm at that time.

The patient underwent flexible bronchoscopy without identification of an endobronchial lesion. Washings and brushings from the right lower lobe were negative for malignant cells, and no organisms grew in culture. Following a multidisciplinary team discussion, a positron emission tomography (PET) scan was performed which identified the lesion adjacent to the bronchus intermedius. There was minimal (18) F-fluorodeoxyglucose uptake with a maximum standardized uptake value (SUVmax) of 2.6 [Figure 1b]. Despite the negative PET scan, the lesion remained suspicious
It is important that the operator can differentiate parenchymal lung lesions from lymphadenopathy as mistakenly labeling a lung lesion as lymph node or vice versa can lead to serious implications for management particularly if a centrally located lesion is erroneously considered an N2 lymph node. In this case, it was easy to differentiate as the lesion had irregular margins and was surrounded by lung tissue that was easy to identify on ultrasound.

The role for flexible bronchoscopy is limited by low sensitivities in nonvisible lesions. CT-guided percutaneous lung biopsy is well established, but complication rates are higher in smaller lesions. Useful data are emerging evaluating the use of EBUS in this setting and publications have reported consistent results. Nakajima et al. reported its use in 35 patients with central pulmonary masses (median short-axis diameter 27.5 mm; range 8–82 mm). EBUS was performed on 19 peritracheal and 16 peribronchial lesions yielding a diagnostic sample in 33 of the 35 cases giving a sensitivity of 94% and diagnostic accuracy of 94%. A larger study of 308 patients with CT and bronchoscopy negative lesions carried out by Eckardt et al. found that EBUS had a diagnostic yield of 72% for central pulmonary lesions, significantly higher than that for lymph nodes (54%) or peripheral lesions (43%), \( P < 0.05 \).

In both studies, EBUS was performed as a day procedure without serious procedure-related complication. Indeed, overall the complication rates from EBUS are reportedly low with results from the recent AcQuIRE registry reporting a pneumothorax rate of 0.2% with <50% requiring chest tube drainage. This compares with 0%–61% pneumothorax rate in CT guided lung biopsy of which 15% need chest tube drainage. It is important that if confirmatory biopsy is not safe or feasible. However, while PET is an extremely sensitive modality for detecting malignancy with sensitivities of 80%–100%, specificity can vary greatly from 40% to 100%. In addition, the size of the lesion has an effect on the sensitivity, with lesions <7 mm having a lower sensitivity. Malignancy rates of 13% have been quoted in biopsies of PET-negative nodules of this size. In our patient, the combination of symptoms and progression over the period of 2 years, combined with negative PET imaging made the alternative diagnosis of infection unlikely.

The ACCP guidelines recommend nonbiopsy assessment with interval CT and PET scan in those cases where the probability of malignancy is low to moderate. However, more invasive procedures such as bronchoscopy, blind TBNA, CT-guided percutaneous biopsy, thoracoscopy, video-assisted thoracoscopic surgery, or exploratory surgery should be employed early in the assessment of lesions with a high clinical suspicion. In general, if the PET scan is negative, an observational approach is often undertaken especially if confirmatory biopsy is not safe or feasible. However, while PET is an extremely sensitive modality for detecting malignancy with sensitivities of 80%–100%, specificity can vary greatly from 40% to 100%. In addition, the size of the lesion has an effect on the sensitivity, with lesions <7 mm having a lower sensitivity. Malignancy rates of 13% have been quoted in biopsies of PET-negative nodules of this size. In our patient, the combination of symptoms and progression over the period of 2 years, combined with negative PET imaging made the alternative diagnosis of infection unlikely.

Figure 1: (a) Computed tomography axial image of the thorax. A 1.1 cm × 1.2 cm lesion is present posterior to the bronchus intermedius (arrow); (b) positron emission tomography computed tomography of the lesion with minimal fluorodeoxyglucose uptake, SUVmax 2.6; (c) ultrasound image of the lesion from the time of endobronchial ultrasound which measured 9.4 mm in diameter; (d) endobronchial ultrasound-transbronchial needle aspiration of the lesion with needle visible on ultrasound.

for malignancy as there was documented persistence and slow growth. A CT-guided biopsy was considered high risk as the lesion was centrally located.

The patient underwent an EBUS under conscious sedation in an ambulatory setting. This revealed a 0.9 cm rounded homogeneous lesion posterior to the bronchus intermedius [Figure 1c]. No mediastinal lymphadenopathy was identified. An EBUS-guided transbronchial needle aspiration (TBNA) was performed [Figure 1d] which revealed atypical cells suspicious for malignancy. A repeat EBUS-TBNA confirmed a well-differentiated adenocarcinoma which was negative for EGFR mutations. A diagnosis of Stage IA – cT1aN0 M0 lung adenocarcinoma was made, and the patient successfully underwent a curative right lower lobectomy. Final pathology was consistent with a pT1aN0 M0.

**Discussion**

This case highlights the important role of EBUS in assessing patients with centrally located nonendobronchial lesions despite indeterminate results from other imaging modalities. There remains no clear consensus on the approach to managing such lesions, and it is difficult to accurately predict which represent malignant disease. Those lesions that are confirmed as malignant represent a potentially curable form of disease.

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This case highlights the management and diagnostic dilemma associated with a small central intrapulmonary lesion which is PET-negative but has demonstrated interval growth on CT imaging and therefore warrants further investigation. In centers without access to EBUS, the next step would likely be exploratory surgery. While surgical methods are likely to yield a diagnosis, these procedures carry much higher risks of complication, and not all patients are suitable candidates for this approach. Even if our case was not eligible for definitive surgery a diagnosis of malignancy allows exploration of other treatment options. In this case, if lesion sampling
through EBUS was not feasible, the patient would have still been offered the option of a lobectomy but with the reservation that the lesion has not been confirmed malignant.

This case emphasizes the importance of a high clinical suspicion, multidisciplinary input, and appropriate utilization of the expertise available in directing the management of patients with suspected lung cancer. In experienced centers, EBUS has a potential for use early in the diagnostic pathway of centrally located solitary parenchymal nodules. However, further studies are needed in this area.

**Declaration of patient consent**
The authors certify that they have obtained all appropriate patient consent forms. In the form the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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**Conflicts of interest**
There are no conflicts of interest.

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