CASE PRESENTATION:
Evolving Role of Advanced Bronchoscopy in Thoracic Oncology

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Advanced bronchoscopy, including endobronchial ultrasound (EBUS) guided transbronchial needle aspiration (TBNA) of mediastinal lymph nodes and electronavigational bronchoscopy (ENB) and biopsy for peripheral lung nodules, has greatly expanded the utility of bronchoscopic techniques in thoracic oncology. Accurate staging, and therefore management, of lung cancer requires access to the mediastinum for lymph node sampling.

A 64-year-old woman was referred for the evaluation of pathologically enlarged metabolically active mediastinal lymphadenopathy (Figure 1) on a routine restaging PET-CT scan. She was originally diagnosed with ER/PR/HER 2 negative breast cancer in 2009, and was treated with chemoradiation, but the chemoradiation was incomplete due to toxicity. She had a supraclavicular lymph node recurrence in 2007 treated with additional chemoradiation. A routine restaging PET-CT scan in March 2010 showed new pathologically enlarged and metabolically active mediastinal lymph nodes, and the patient was referred for biopsy. She felt well and was asymptomatic. She had a 40-pack-year smoking history, and her grandmother and uncle died of lung cancer.

It was felt the patient either had recurrent and metastatic breast cancer or sarcoid-like granulomatous inflammation in the mediastinal lymph nodes. EBUS-guided TBNA of level 4 paratracheal (Figure 2) and level 7 subcarinal lymph nodes was performed as an outpatient procedure, and recurrent and metastatic breast cancer was confirmed.

EBUS
There are multiple approaches to biopsy mediastinal lymph nodes (Table 1). Lymph node enlargement on CT scan does not constitute proof of metastatic disease. In contrast to mediastinoscopy and/or mediastinotomy, EBUS-TBNA allows access to posterior subcarinal and hilar lymph node stations that would otherwise be inaccessible. EBUS-TBNA also can be performed in situations where mediastinoscopy is difficult or overly risky, such as in patients with a tracheostomy or cervical spine deformity, or in patients with a prior mediastinoscopy. The advantages of EBUS-TBNA are 1) easily accomplished in outpatient bronchoscopy lab with IV sedation, 2) safest risk profile, and 3) most time-efficient.

EBUS-TBNA provides access to paratracheal (level 4), subcarinal, including posterior (level 7), and hilar (levels 10, 11) lymph nodes. Dedicated biopsy needles (21-gauge) are inserted through the 2 mm working channel to perform aspirations (Figure 2) for cytology. If there are difficulties achieving adequate EBUS images, a saline-filled balloon surrounding the transducer can be inflated to improve image quality. There also are Doppler capabilities to allow vascular structure differentiation, minimizing unintended vascular puncture. Many well-designed studies have demonstrated that the diagnostic yield from
EBUS-TBNA can approach 90% sensitivity and negative predictive value, with 100% specificity. In addition, EBUS-TBNA is superior to CT or PET-CT at detecting hilar and mediastinal metastatic disease, especially identifying regional nodal metastases in radiographically “normal” lymph nodes. Given the importance of accurate mediastinal lymph node assessment in lung cancer staging, treatment, and prognosis, the ability of EBUS to allow for more accurate staging is a significant advance.

UPMC specialists have been performing EBUS-TBNA since October 2006. Our initial experience has been published (1, 2) and confirms the safety and clinical utility of this procedure as a diagnostic tool in patients with mediastinal lymphadenopathy. EBUS-TBNA is especially useful for mediastinal staging for lung cancer, with the added benefit that it can be repeated, such as post neoadjuvant chemotherapy for pathologic restaging. It has become the procedure of choice for the diagnosis of sarcoidosis. It is very useful for documenting cancer recurrence as in the case presented.

The patient was treated with chemotherapy and achieved remission. Three years later, a routine restaging CT chest showed a growing 9 mm LUL nodule that was present in retrospect the year before (Figure 3). The nodule was adjacent to a bronchovascular bundle and had a positive bronchus sign (see arrow Figure 3). There were no mediastinal abnormalities.

It was felt that the new, growing solitary LUL nodule most likely represented malignancy. The issue was whether it was recurrent and metastatic breast cancer, or lung cancer. If it was lung cancer, surgical resection or stereotactic radiation would be favored. If it was recurrent breast cancer, then additional systemic therapy would be indicated. Despite the relative small size of the nodule, the presence of a bronchus sign is a favorable indicator for the success of ENB. Given the patient’s prior favorable experience with EBUS, she elected to proceed and ENB was carried out in the bronchoscopy suite under IV sedation. The procedure was well-tolerated and the patient was discharged home within four hours of her arrival. The biopsy showed adenocarcinoma, with primary lung cancer favored based on immunohistochemistry profile of the tumor.

**ENB**

ENB works on the same triangulation principle as a global positioning system and allows the bronchoscopist to direct a steerable probe through the airways to a peripheral target. ENB combines three technologies: 1) planning software that converts DICOM images from a CT scan into 3D reconstruction and virtual bronchoscopy of the airways, 2) steerable sensor probe designed with the ability to navigate turns in the endobronchial tree, and 3) electromagnetic navigational board that emits low frequency electromagnetic waves and is connected to a computer containing the planning data. Volumetric high-resolution CT images are acquired using a specialized algorithm from which a virtual pathway fused with real-time bronchoscopy images is constructed allowing access to peripheral lung lesions as small as 1 cm that would otherwise be hidden. To do this, the bronchoscopist passes the steerable sensor through the bronchoscope to the targeted lesion utilizing known landmarks in the patient’s airways determined by triangulation from the electromagnetic field surrounding the patient. Acknowledging a rather steep learning curve for ENB, the diagnostic yield approaches 70% in experienced centers such as UPMC. Factors that improve the diagnostic yield include larger nodule size and presence of bronchus sign (3).

**Suggested reading:**

**EBUS-TBNA**

Consults and referrals: Please call the UPMC Comprehensive Lung Center at 412-648-6161.