



Biopsy: bronchoscopy is best-interventional pulmonologists perspective

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Abstract: Knowledge of pulmonary medicine along with extensive training in minimally invasive airway and lung procedures provides interventional pulmonologists with a unique perspective on the management of lung nodules. The evolution of lung cancer screening has resulted in an increase in the number of nodules identified in patients with high pre-test probability of cancer. The ability to sample nodules using electromagnetic navigation bronchoscopy (ENB) along with biopsying mediastinal lymph nodes using endobronchial ultrasound (EBUS) bronchoscopy during one procedure brands bronchoscopy as the modality of choice for diagnosing and staging individuals with malignant lung nodules. Neither computer tomography (CT) scanning nor positron emission tomography (PET) scanning is optimal modalities for staging the mediastinum. The ability of to safely and effectively biopsy nodules through ENB, along with simultaneous staging the mediastinum using EBUS, makes bronchoscopic biopsy the ideal approach for sampling lung nodules identified through lung cancer screening.

Keywords: Interventional pulmonology; electromagnetic navigation bronchoscopy (ENB); endobronchial ultrasound bronchoscopy (EBUS bronchoscopy)

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Introduction

Interventional pulmonology has bridged the gap between general pulmonology and thoracic surgery. Knowledge of pulmonary medicine along with extensive training in minimally invasive airway and lung procedures provides interventional pulmonologists with a unique perspective on the management of lung nodules. The ability to sample nodules using electromagnetic navigation bronchoscopy (ENB) along with biopsying mediastinal lymph nodes using endobronchial ultrasound (EBUS) bronchoscopy during one procedure brands bronchoscopy as the modality of choice for diagnosing and staging individuals with malignant lung nodules.

Lung cancer screening using low dose computer tomography (CT) has proven to be effective in decreasing mortality due to lung cancer in high-risk patients compared to radiographic screening (1). Although the majority of

nodules identified on lung cancer screening CTs are benign, the high pre-test probability of cancer in screened patients requires physicians to have a low threshold to sample such lesions. As a result, any lung nodules identified on low dose CT scan during lung cancer screening must be followed with regular closely or sampled through modalities including bronchoscopy, transthoracic needle aspiration (TTNA), or surgical resection. While the various modalities used to biopsy lung nodules boast specific benefits, each has inherent risks.

ENB

Tissue sampling of peripheral lung nodules is commonly performed bronchoscopically using ENB. This form of bronchoscopy is an image-guided localization procedure utilizing steerable catheters combined with highly specialized navigation software to create three-dimensional

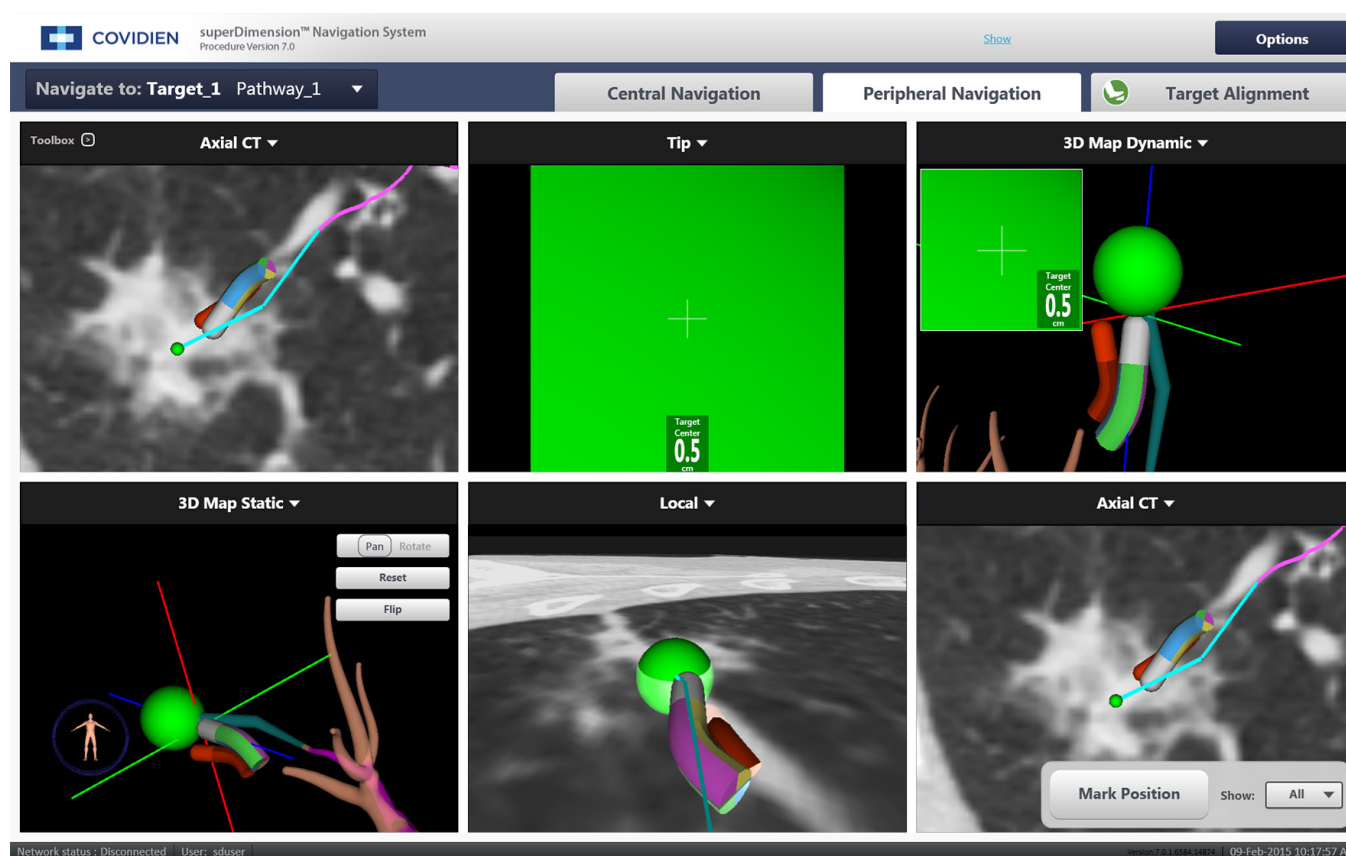


Figure 1 Electromagnetic navigation bronchoscopy with locatable guide approaching nodule.

anatomical maps. The ENB system is comprised of an electromagnetic board, locatable guide, extended working channel, and a steerable catheter to sample lung nodules in intermediate and high-risk patients. By directing the locatable guide along the created pathway to peripheral lesions, in a manner similar to that of global positioning software (GPS), a bronchoscopist can perform brushings, biopsies, and washings of target nodules (*Figure 1*). Along with sampling peripheral lung lesions with ENB, physicians with advanced training in EBUS bronchoscopy are able to effectively biopsy lymph nodes in the mediastinum to determine a cancer stage during the same procedure. As a result, the ability to biopsy lung nodules and simultaneously stage the mediastinum makes bronchoscopy the ideal diagnostic modality to sample nodules identified through lung cancer screening.

ENB is an effective and safe procedure. Peripheral lesions in the outer third of the chest less than 2 cm in diameter have a diagnostic yield of only 14% using conventional flexible bronchoscopy (2). Utilization of ENB

in conjunction with use of a radial endobronchial ultrasound (R-EBUS) results in a yield of approximately 88% (*Figure 2*) (3). Additionally, the safety of the procedure is excellent, with a pneumothorax rate between 0–10% (4,5). Alternative options for sampling peripheral lung nodules include TTNA and surgical biopsy. Transthoracic needle aspiration is effective, with a yield of approximately 80%, the risk of pneumothorax associated with TTNA range anywhere from 5% to 64% (6-12).

EBUS bronchoscopy

While sampling peripheral lung nodules identified during lung cancer screening is essential, obtaining appropriate nodal staging may be equally as important in determining disease treatment. Patients are staged according to the tumor, node, metastasis (TNM) staging system based on tumor size, nodal station, and presence of metastases. The importance of nodal involvement is highlighted as 1- and 5-year survival significantly decreases in the presence of N1,

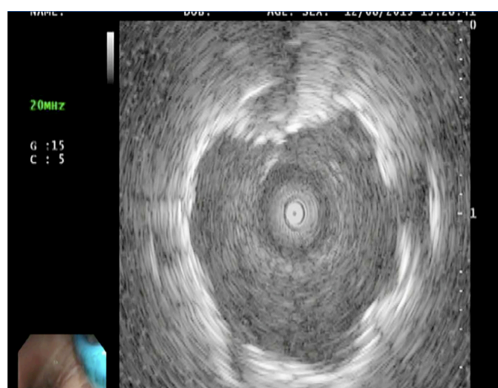


Figure 2 Concentric radial endobronchial ultrasound image of right upper lobe nodule.

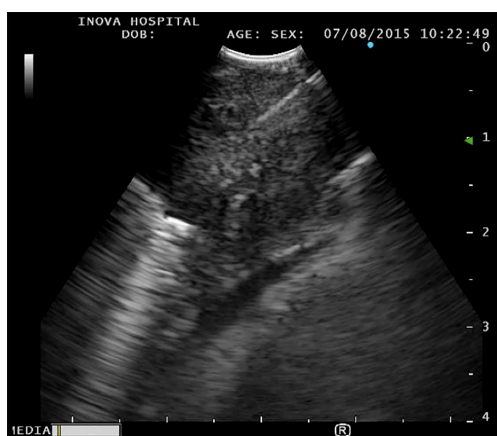


Figure 3 Linear endobronchial ultrasound transbronchial needle aspiration image of station 11R lymph nodes.

N2, and N3 disease (13). Additionally, nodal staging has significant implications regarding potential curative surgery versus maintenance chemotherapy.

The American College of Chest Physicians (ACCP) recommendation for the mediastinal staging of patients with non-small cell lung cancer endorses EBUS bronchoscopy (14). Through real time ultrasound imaging, EBUS provides clear images of lymph nodes and proximal lung masses that can be adequately sampled through transbronchial needle aspiration (TBNA) (*Figure 3*). EBUS is a minimally invasive, outpatient procedure. Large studies investigating the use of EBUS for mediastinal staging have shown the procedure to be highly sensitive (93%) and specific (100%) while harboring an excellent safety profile (15). Pulmonologists with extensive training in

performing EBUS bronchoscopy are capable of accurately staging the mediastinum by sampling lymph nodes as small as 5 mm. When peripheral lung nodules are sampled using ENB, the use of EBUS to stage the mediastinum is virtually always performed during the same procedure. As a result, unlike TTNA which does not offer access to mediastinal lymph nodes, advanced bronchoscopy utilizing EMN and EBUS to diagnose and stage lung cancer is the ideal to biopsy lung nodules identified through lung cancer screening.

CT and positron emission tomography (PET) for mediastinal staging

CT scans and PET scans have been used for clinical staging for patients with lung cancer. Prior to the advent of EBUS bronchoscopy, mediastinoscopy was used to obtain a mediastinal stage for patients with lung cancer and concern for N2 or N3 disease. While mediastinoscopy is highly sensitive and specific, it is invasive. Patients with lung nodules and the absence of lymph node enlargement or with a negative PET scans often go directly to surgery without histologic confirmation of N0 disease. Unfortunately, neither CT scanning nor PET scanning are optimal modalities for staging the mediastinum. Lymph node size is criterion used to distinguish benign from malignant lymph nodes and is inherently erroneous. The combined sensitivity of CT scanning for identifying malignant lymph nodes is 60–83%, with a specificity of 77–82%, and an accuracy of 75–80% (16,17). Although PET scanning harbors a higher sensitivity and specificity than CT in differentiating hyperplastic or reactive lymph nodes from metastatic lymph nodes, 79% and 91% respectively, it remains lower than that of EBUS bronchoscopy (17,18).

Conclusions

The escalating implementation of lung cancer screening represents a significant step for reducing lung cancer related mortality. In the process of detecting and treating lung cancer at early stages, screening implementation has identified a growing number of benign and malignant nodules. Because the majority of lung nodules identified through lung cancer screening are benign, it is essential that these nodules are biopsied through minimally invasive methods prior to resection. Additionally, if nodules are highly suspicious for malignancy, the mediastinum should be staged if lymphadenopathy is identified on a CT or

PET scan. The ability of to safely and effectively biopsy nodules through ENB, along with simultaneous staging the mediastinum using EBUS, solidifies bronchoscopy as the most effective, safe, and expeditious means to guide treatment for lung nodules identified during lung cancer screening.

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Footnote

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