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Lung cancer staging - PET and Endoscopic Ultrasound

Role of EUS-FNA in Mediastinal Lymphadenopathy:

Can obviate the need for more invasive procedures such as mediastinoscopy, thoracoscopy, and thoracotomy
Is cost-effective: Low cost and high yield. Especially useful if lymphadenopathy is present on CT but bronchoscopy negative.
Complementary to PET scanning to rule out false positive results
Limitations: Anterior mediastinum (air-filled trachea absorbs sound)

Carcinoma of the lung remains among the leading causes of death in our region. For those with non-small cell lung cancer (large cell, squamous and adenocarcinoma), surgery remains the only hope for cure. Unfortunately, it is a hope that is too frequently shattered by the reality of unresectable disease at thoracotomy. The challenge is to identify *pre-operatively* those patients with N0, N1, or minimal N2 disease, who are candidates for curative resection and to avoid surgery in patients with advanced N2 or N3 disease. This is the promise of metabolic imaging:

Fluorodeoxyglucose labeled with the positron emitter F18 is injected intravenously and metabolically trapped in tumor cells. This allows imaging using positron-emission tomography (PET). There is an accumulating body of evidence that PET imaging is more accurate than CT in the mediastinal staging of lung cancer. The data are indeed quite convincing and the staging algorithm for lung cancer will need to be reformulated with the availability of PET scanning.

The issue: False-positive PET

False-negative results with PET scanning can occur with small tumor volumes or when PET cannot differentiate the tumor from contiguous lymphadenopathy. From the patient's point of view a false-positive result is more serious if potentially life-saving surgery is denied. False-positive results can occur with benign inflammatory disease and for a few other reasons. It is therefore recommended that patients with a positive PET study undergo confirmatory mediastinal biopsy.

The tissue: Mediastinoscopy, Bronchoscopy and Transesophageal Endoscopic Ultrasound with biopsy

The American Thoracic Society has standardized a lymph node map which demarcates the anatomic boundaries between lymph node stations in metastatic NSCLC. This mapping system is used in the literature to document location of malignant lymph nodes when comparing staging modalities. Figure 1..

Suspicious subcarinal lymph nodes may be biopsied with *transbronchial FNA* through a bronchoscope, which has a sensitivity of 80-90% and a specificity of 100%. Percutaneous transthoracic fine needle aspiration of mediastinal lymph nodes can be performed if the nodes are greater than 2 cm diameter.

Cervical mediastinoscopy is performed under general anesthesia and involves making an incision in the suprasternal sternal notch and placing a rigid scope into the mediastinum. There is access to lymph nodes at the tracheobronchial angle (10L and 10R). Dissection is needed to reach the upper (2Land 2R) and lower (4L and 4R) lymph nodes. Access to subcarinal lymph nodes also requires dissection. Nodes in the aorticopulmonary window can be reached with difficulty. Mediastinoscopy is generally safe, and has the potential complications of incision discomfort and scarring, transient hoarseness, and bleeding. Mediastinoscopy has a sensitivity of 70-95% and a specificity of 100%.

Electronic linear array echoendoscopes with large biopsy channels allow real-time EUS-guided fine needle aspiration (FNA) to be performed of structures within 5 cm of the luminal GI tract, such as pancreatic masses, retroperitoneal lymph nodes, and posterior mediastinal lymph nodes.

EUS guided FNA of suspicious lymph nodes

With the introduction of the linear array echoendoscope, three large series have been reported describing EUS-guided FNA in the evaluation of patients with non-small-cell lung cancer. Pedersen et. al., from Denmark, reported on nine patients with CT scans showing posterior mediastinal masses or lymphadenopathy in whom EUS-guided FNA was used to diagnose lung cancer. Silvestri, from the Medical University of South Carolina, reported that for 27 patients with known or suspected lung cancer, EUS found malignant appearing posterior mediastinal lymph nodes in 15 patients, and FNA was positive for malignancy in all nodes. The lymph nodes were assessed in levels 5, 7, and 10R. There were 10 patients with NSCLC and 5 patients with SCLC. Among the 10 NSCLC patients, 3 had contralateral nodes which deemed them unresectable. One patient was also found unresectable based on aortic invasion by a lymph node. Among the 11 patients who underwent surgery, 2 were found to have malignant nodes. In this study, the sensitivity was 89%, specificity 100%, and accuracy 100%, all of which were better than CT scanning. Gress, Savides and colleagues from Indiana University performed EUS on all patients with potentially resectable NSCLC who on CT were found to have mediastinal adenopathy greater than 1 cm in diameter.(17) Among 130 patients with NSCLC, 52 (40%) were found to have mediastinal nodes on CT greater than 1 cm. 17 of the 52 patients had EUS before the advent of FNA, and 35 had EUS with the possibility of simultaneous FNA. Among the 35 patients, 24 (69%) underwent FNA, and 14 (40%) had a positive FNA which upstaged the patient to unresectable status. The accuracy of EUS/FNA in diagnosing malignant mediastinal lymph nodes was 95%.

A recent study published in Chest (2000;117:339-45) prospectively evaluates EUS-FNA in 35 patients with suspected but undiagnosed lung cancer (negative bronchoscopy): Endoscopic ultrasound guided fine needle aspiration biopsy achieved a diagnostic accuracy of 97% with no false-positives.

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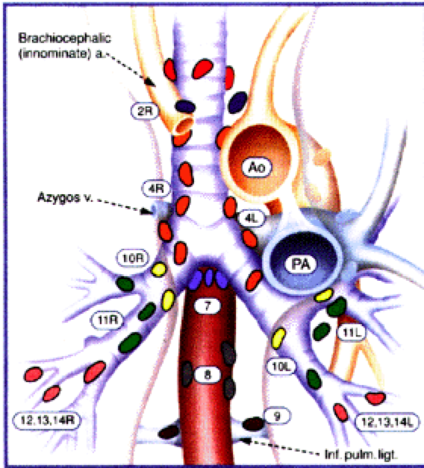

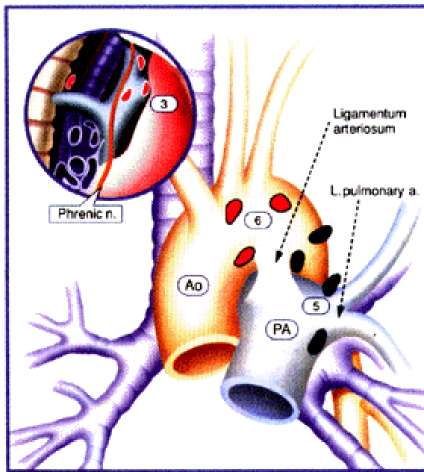

Superior Mediastinal Nodes

- 1 Highest Mediastinal
- 2 Upper Paratracheal
- 3 Pre-vascular and Retrotracheal
- 4 Lower Paratracheal (including Azygos Nodes)

N_2 = single digit, ipsilateral
N_3 = single digit, contralateral or supraclavicular

Aortic Nodes

- 5 Subaortic (A-P window)
- 6 Para-aortic (ascending aorta or phrenic)

Inferior Mediastinal Nodes

- 7 Subcarinal
- 8 Paraesophageal (below carina)
- 9 Pulmonary Ligament

N_1 Nodes

- 10 Hilar
- 11 Interlobar
- 12 Lobar
- 13 Segmental
- 14 Subsegmental

(Mountain/Dresler modifications from Naruke/ATS-LCSG Map)

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