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Review Article

Anesthetic Considerations for Mediastinal Staging Procedures for Lung Cancer

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Tumor staging is critical for the treatment of lung malignancies. Invasive techniques of lung tumor staging can be accomplished via mediastinoscopy, endobronchial ultrasound, and video-assisted thoracoscopy. Anesthesiologists taking care of patients undergoing mediastinal staging procedures might face different challenges. In this narrative review, the authors summarize the literature on the anesthetic considerations for mediastinal staging procedures.

Key Words: lung cancer; staging; mediastinoscopy; ultrasound; anesthesia

THE TREATMENT OF potentially resectable lung cancers is guided by their staging, which is determined primarily by the magnitude of micrometastasis present in pleural nodes, the presence of distant metastasis, and cellular dysplasia. The initial staging for lung cancers begins with noninvasive radiologic techniques such as computed tomography (CT) and positron-emitted tomography (PET).[1] Unless lymph nodes are bulky (>1.5 cm in diameter), radiographic imaging, including both CT and PET, carries a significant rate of both false positivity and false negativity.[2] Integrated PET/CT shows substantially higher accuracy in overall tumor staging over CT and PET interpreted separately.[3] However, the sensitivity of integrated PET/CT to detect malignant nodal involvement is only 32.4% in nodes <10 mm and 85.3% in nodes ≥ 10 mm.[4] In fact, the American College of Chest Physicians recommends that with either test, CT or PET, abnormal findings must be confirmed with tissue biopsy to ensure accurate staging.[5] Therefore, the most accurate detection of nodal metastatic disease still relies on histopathologic techniques. Unfortunately, nodal biopsy, according to current guidelines, still is not a common practice and many patients with "positive" PET/CT scans are erroneously labeled as having advanced disease and treated as such.[6–8]

Surgery seems to be most beneficial for patients who have had a downstaging (reduction in pathologic staging after radiation or chemotherapy) or accurate quantification of their mediastinal disease.[4,9,10] However, after induction chemotherapy, CT, PET, and re-mediastinoscopy carry a false negative rate of 20% to 30%.[11] Due to the limitations of these imaging techniques to detect microscopic disease, the concept of invasive (surgical or transbronchial) re-staging (defined as the process to determine the degree of tumor response after treatment) has emerged as a tool. However, unfortunately, the

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yield of techniques such as endobronchial ultrasound (EBUS) after induction therapy also is low.[10] Presently, for those who believe in the concept of surgery only after downstaging, the best approach seems to be the less-invasive EBUS on initial evaluation followed by mediastinoscopy after induction therapy or EBUS in patients who initially were evaluated with mediastinoscopy.[12]

Based on current recommendations, it is expected that the number of mediastinoscopies and EBUS or esophageal ultrasound (EUS)–guided nodal biopsies will rise in the near future to adequately stage patients with lung cancer before and after neoadjuvant therapy.[5] Therefore, the education of anesthesiologists who will face the challenges associated with these procedures needs to be considered. It is imperative that anesthesiologists recognize some of the technical details and potential complications of any staging procedure to safely administer sedation or general anesthesia. The objective of this narrative review is to summarize the current literature on general aspects and the anesthetic considerations for the 3 following most common methods of invasive staging: mediastinoscopy, EBUS, and video-assisted thoracoscopy (VATS).

Surgical Techniques for Lung Cancer Staging and Anesthetic Considerations

General Considerations

Mediastinoscopies and EBUS for lung cancer staging typically are performed with the patient under moderate to deep sedation or general anesthesia generally as outpatient procedures; however, occasionally patients might remain admitted after more invasive procedures.[13] For an anesthetic plan to be developed, the patient's medical and surgical history, medication use, physical examination, functional status, and imaging need to be evaluated. Preoperative communication with the surgeon regarding estimates of potential blood loss and subsequent communication with the blood bank are essential.[14,15]

Lymph Node Classification for Lung Cancer Staging

The International Association for the Study of Lung Cancer names regional nodes according to their vicinity to anatomic structures that are closely related. The association has defined 7 zones and 14 node stations to reconcile other lymph nodes maps such as the Naruke lymph node map and the Mountain-Dresler modification of the American Thoracic Society lymph node map.[16] The 7 zones include the different nodes stations as follows: the supraclavicular zone (station 1), the upper zone (stations 2-4), the aortopulmonary zone (subaortic lymph nodes and paraortic lymph nodes [station 5]), the subcarinal zone (subcarinal lymph nodes [station 6]), the lower zone (paraesophageal lymph nodes and pulmonary ligament lymph nodes [stations 7 and 8]), the hilar and interlobar zone (hilar lymph nodes and interlobar lymph nodes [stations 9 and 10]), and the peripheral zone (lobar lymph nodes, segmental lymph nodes, and subsegmental lymph nodes [stations 11, 12, and 13]) (Fig 1).[16]

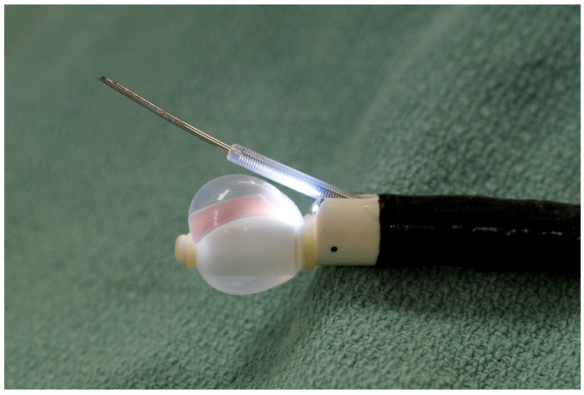

Fig 1. Nodes stations accessible by endobronchial ultrasound or esophageal ultrasound.

Cervical Mediastinoscopy (Simple/Video-Assisted or Extended)

Since the 1980s, cervical mediastinoscopy has been used extensively in the staging of mediastinal lymph nodes. A retrospective study of more than 6,500 patients undergoing mediastinoscopy between 1985 and 2003 demonstrated that the average sensitivity of mediastinoscopy to detect mediastinal lymph node involvement is approximately 80% and the average false negative rate is approximately 10%.[17] False negative results mainly occur in lymph node stations that are not reachable with mediastinoscopy (Fig 1). The yield of the technique is also surgeon dependent. In a study of the pattern of practice in the United States, Little et al found that mediastinoscopy is infrequently performed and lymph nodes are biopsied in fewer than 50% of patients.[18] In agreement with Little's study, a recent study indicated that the rate of mediastinoscopy in the Mid-South of the United States is low (11%).[19]

Cervical mediastinoscopy can be performed either in a simple, anterior, or extended (subaortic/paraaortic nodes) technique. Cervical (simple) mediastinoscopy is performed via a midline transverse incision made immediately above the sternal notch (Fig 2). Mediastinal stations 5 (subaortic) and 6 (paraaortic) cannot be reached with cervical mediastinoscopy (Fig 1). Therefore, if there is evidence of nodal disease in these stations, a left anterior mediastinoscopy, also known as the Chamberlain procedure, can be used to sample these nodes. This surgical procedure is performed through a parasternal incision at the third intercostal space through which the mediastinoscope is inserted.[20] The Chamberlain procedure can be combined with cervical mediastinoscopy, with the patient in a supine position, to give a very comprehensive assessment of nodal disease of the mediastinum in patients with left sided lung cancer. Even though the morbidity associated with the Chamberlain procedure is low, complications such as injury of the left internal mammary artery remain higher than with simple mediastinoscopies.[21] Extended

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