



Review Article

Lung Cancer Staging by Endoscopic and Endobronchial Ultrasound-Guided Fine-Needle Aspiration

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ABSTRACT

Endoscopic and endobronchial ultrasound are complementary techniques. When combined, they allow for nearly complete mediastinal staging in lung cancer. Each technique has inherent strengths and weaknesses, but when used simultaneously they become far more powerful, to the extent that mediastinoscopy—a more expensive and invasive procedure—is expected to decline in use as the application of endoscopic and endobronchial ultrasound becomes more widespread. The incorporation of these ultrasound techniques has been shown to lead to fewer thoracotomies, benefiting patients and also society, given that costs are thereby reduced. We reflect on recent developments in the field, discuss current debates, and propose a view of what the future holds in store.

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Estadificación del cáncer de pulmón mediante punción aspirativa con aguja fina guiada por ultrasonografía endoscópica y endobronquial

RESUMEN

La ultrasonografía endoscópica y la endobronquial son métodos complementarios. Combinadas, permiten una estadificación mediastínica casi completa del cáncer de pulmón sin cirugía. Son más potentes cuando se utilizan simultáneamente, ya que cada una de ellas tiene puntos fuertes y puntos débiles. Es de esperar que con la utilización de ambas se reduzca el uso de la mediastinoscopia (un proceso más caro e invasivo). Se ha demostrado que el empleo de ambas técnicas conduce a la realización de menos toracotomías, lo que beneficia no sólo a los pacientes, sino también a la sociedad, ya que se ahorran costes. En el artículo se realiza también una reflexión sobre los avances más recientes en este ámbito, se examinan los debates actuales al respecto y se presenta una perspectiva para el futuro.

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Introduction

Even though the age-adjusted incidence of lung cancer has been decreasing in countries where smoking cessation efforts have been successful,¹ the disease has acquired epidemic proportions worldwide. In Asia the lung cancer burden will be increasing rapidly² adding to the other public health challenges

some nations in this region are already facing. Lung cancer mortality in women is increasing in Spain³ and in many countries of Latin America.⁴ The majority (up to 80%) of new cases will be non-small cell lung cancer (NSCLC). Evidence-based treatment strategies for lung cancer require accurate staging, with an apparently bewildering choice of noninvasive, minimally-invasive, and invasive staging methods. Over the last decade endoscopic ultrasound (EUS) guided fine-needle aspiration (FNA) of mediastinal lymph nodes has been established as a valuable adjunct in the diagnosis and staging of this disease, with numerous publications attesting to that fact. More importantly,

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EUS-FNA combined with the recently developed endobronchial ultrasound (EBUS) guided FNA (EBUS-FNA) can facilitate complete minimally-invasive mediastinal staging at a lower initial cost to patient and society than other traditionally employed methods. Furthermore, both methods combined can help avoid futile thoracotomies, leading to further savings and a decrease in treatment-related morbidity.

This review will describe recent developments in the field, highlight current debates, and present an outlook for the future.

Initial Diagnosis of Lung Cancer

If small cell lung cancer is suspected, based on computed tomography (CT) scans and clinical presentation for example, the diagnosis should be achieved by the easiest available method. Once the diagnosis is established, the distinction between limited and extensive disease is made radiographically.⁵ In contrast, in patients who are suspected to have NSCLC, diagnosis and staging should be accomplished concurrently, if possible, and the choice of diagnostic method is suggested by the presumed stage of disease. For example, if a pleural effusion is present, an aspirate for cytology should be obtained. This does not necessarily mean that a separate thoracentesis needs to be arranged since aspiration of pleural fluid can be done during EUS-FNA of enlarged mediastinal lymph nodes. Most patients with suspected lung cancer will initially undergo bronchoscopy, and most of these procedures will be done without any attempt at blind transbronchial FNA (with the Wang needle). This may be a rational choice but often it is not the optimal approach if the goal is to obtain the most information with the fewest tests and procedures. Even if only diagnostic information (as opposed to combined diagnostic and staging information) is the goal, bronchoscopy yields a false negative result in up to 30% of cases even if brushings, washings, and transbronchial biopsies are performed.⁶ Several studies have examined the performance of EUS-FNA for obtaining the initial diagnosis of lung cancer after a nondiagnostic bronchoscopic procedure. For example, in a series of 35 patients with nondiagnostic bronchoscopies, Fritscher-Ravens and colleagues⁷ were able to diagnose all but 1 patient correctly using EUS-FNA. Another more recent prospective study of 20 patients in Singapore evaluated the performance of EUS-FNA immediately after nonrevealing bronchoscopy⁸ in a single-session approach that achieved a yield of 90%. It is not surprising that other authors have started to study EUS-FNA as the initial diagnostic modality for the diagnosis of lung cancer.^{9,10} However, the real question is not whether bronchoscopy or EUS-FNA should be performed but when we should select one over the other as the initial diagnostic technique. Or, with a view to the future, are we evolving towards single-session chest endoscopy using EUS-FNA or conventional bronchoscopy and EBUS-FNA as required? Before we examine staging approaches now and in the future let us briefly look back.

Historical Perspective

A practical way of performing bronchoscopy was first described in Germany by Gustav Killian in 1897.¹¹ In the United States, "broncho-esophagology" was firmly established by Chevalier Jackson, in Philadelphia, who led the field well into the

1940s.¹² It was only natural that the rigid broncho-esophagoscope would be used by the same individual to examine both structures since the skill required to handle the instrument was little different in the esophagus or the tracheobronchial tree. In fact, perforations caused by the instrument were invariably fatal and few individuals outside the field of broncho-esophagology felt a desire to get involved. Rigid esophagoscopy or bronchoscopy was later practiced almost exclusively by chest surgeons. In the 1950s the field was very much alive and Schieppati¹³ described sampling mediastinal lymph nodes with a rigid bronchoscope through the tracheal carina at the Argentine Meeting of Broncho-Esophagology in 1949. Broncho-esophagology became extinct when flexible endoscopes emerged victorious, allowing internists in gastroenterology, pulmonology, and cardiology to adopt and adapt the instruments for and to their purposes. Blind transbronchial needle biopsies (TBNA) with newer types of needles appropriate for flexible endoscopes, such as the Wang needle,¹⁴ came into wider use only in the mid-1980s but are still underutilized. Only 12% of North American bronchoscopists routinely use TBNA and 29% use it occasionally.^{15,16} Reasons given include operator inexperience, low yields, and concern regarding great vessel puncture. In 1 study the best predictor of obtaining a diagnostic sample with TBNA was lymph node size greater than 2 cm.¹⁷ A major breakthrough was heralded by reports of real-time ultrasound guided transesophageal mediastinal lymph node biopsies using curved-linear array echoendoscopes, as first described by Wiersema and colleagues.^{18,19} The instruments used have now been sufficiently miniaturized to facilitate introduction into the tracheobronchial tree to allow real-time ultrasound-guided transbronchial biopsies.²⁰ It is anticipated that these developments will lead to a major change in the way lung cancers are staged.

Staging of Lung Cancer by Sampling (Invasive Staging)

If distant metastases have been ruled out, the status of the mediastinum becomes crucial. The pooled sensitivity and specificity of CT scanning for identifying mediastinal lymph node metastasis are 51% and 85%, respectively. For positive emission tomography (PET) scanning, the figures are 74% (95% confidence interval [CI], 69%-79%) and 85% (95% CI, 82%-88%).²¹ Even with the newer integrated PET-CT images, the presence of occult N2 disease in patients with negative mediastinal uptake remains a problem, with an incidence of 16% in a recent large study.²² In many clinical situations confirmation of the results of the status of the mediastinal nodes by sampling will therefore be necessary and is recommended by the 2007 guidelines of the American College of Chest Physicians (ACCP).²³

This type of staging is typically called invasive although the term may be misleading given that EUS- and EBUS-FNA are so minimally invasive, with very few complications. In this regard one may conceptually divide the staging of lung cancer into an imaging and a sampling stage. Sampling of mediastinal lymph nodes can be done with mediastinoscopy, EUS-FNA, TBNA, EBUS-FNA, transthoracic FNA, video-assisted thoracoscopy, the Chamberlain procedure, and extended cervical mediastinoscopy. Unfortunately, it is difficult to compare the usefulness of these tests in different clinical scenarios because the available studies are mostly defined by the particular tests the patients have undergone rather than by radiographic or clinical criteria that

could be used prospectively to select patients for a particular approach. Deterbeck and colleagues²³ suggest that the staging tests are selected according to 4 radiographic groups: group A has obvious mediastinal tumor infiltration and invasive staging is not required, group B shows discretely enlarged mediastinal lymph nodes on CT scan which may or may not be neoplastic, group C consists of patients with clinical stage II (N1 lymph nodes) or central stage I tumors and is the group where occult mediastinal disease is of the highest concern, and group D comprises patients with peripheral clinical stage I tumors.

A recent meta-analysis of EUS-FNA for the staging of NSCLC has shed some light on the performance of this technique in these different patient populations although they do not exactly conform to the above mentioned radiographic groups.²⁴ The first group consisting of 8 studies comprised patients who had discretely enlarged mediastinal lymph nodes on CT.^{7,25-31} In this scenario, the pooled sensitivity was 90% (95% CI, 84%-94%) and the specificity was 97% (95% CI, 95%-98%). In 4 studies with

patients without enlarged mediastinal lymph nodes on CT^{27,32-34} the pooled sensitivity was 58% (95% CI, 39%-75%). A total of 1201 patients were included in the analysis from 18 eligible nonoverlapping studies, 16 of which were prospective. Only 10 patients had minor complications (0.8%), the majority of which were reported from a single center, and no major complications were recorded. The performance of EUS in patients without enlarged mediastinal lymph nodes appears disappointing, given a sensitivity of 58%. Nevertheless, if EUS is performed in this context as a first staging test and is positive, it will help avoid more invasive staging procedures or surgery. In the future combined use of EUS and EBUS is likely to improve on these results.

For patients with centrally located tumors or N1 disease, the ACCP guidelines recommend invasive staging (this applies to patients with or without mediastinal lymph node enlargement on CT regardless of the PET scan findings). Furthermore, for patients with discretely enlarged mediastinal lymph nodes, invasive confirmation of the radiographic stage is recommended (regardless of the PET results). In peripheral tumors which appear clinically to be stage I and which show no mediastinal uptake on PET, no invasive mediastinal staging is needed. On the other hand, a peripheral tumor which—prior to PET—clinically appears to be stage I but shows uptake on PET in the mediastinum, should undergo invasive mediastinal staging for confirmation. If needle-aspiration techniques are used (EUS-FNA, TBNA, EBUS-FNA, or transthoracic FNA) a nonmalignant result should be further confirmed by mediastinoscopy²³ (Figure 1).

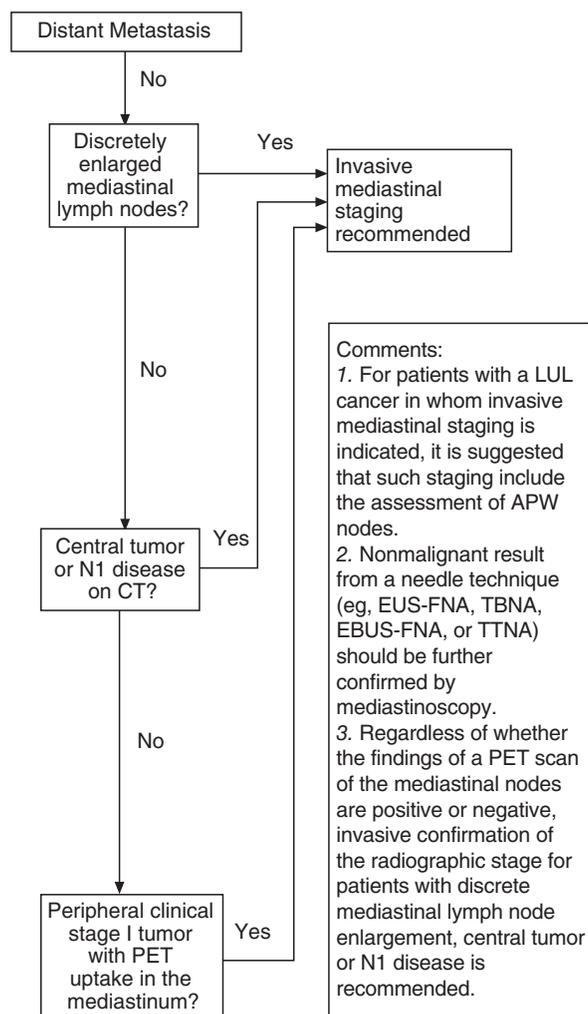


Figure 1. This flow diagram summarizes the invasive mediastinal staging guidelines of the American College of Chest Physicians (ACCP).¹ APW indicates aortopulmonary window; CT, computed tomography; EBUS, endobronchial ultrasound; EUS, endoscopic ultrasound; FNA, fine-needle aspiration; LUL, left upper lobe; NSCLC, non-small cell lung cancer; PET, positive emission tomography; TBNA, transbronchial needle aspiration.

Mediastinoscopy: A Tarnished Gold Standard?

Mediastinoscopy has been an accepted standard for mediastinal staging of NSCLC for many years. Right and left high and low paratracheal nodes (stations 2R, 2L, 4R and 4L), pretracheal nodes (stations 1 and 3), and anterior subcarinal nodes (station 7) are accessible. Inferior mediastinal nodes (stations 8 and 9), the aortopulmonary window (station 5) and anterior mediastinal nodes (station 6), however, are not. The average sensitivity of mediastinoscopy in published studies is approximately 80% and the average false negative rate is approximately 10%.²³ Approximately half of false negatives are due to nodes that were not accessible to mediastinoscopy. The false-negative rate is also affected by the diligence with which nodes are dissected. Ideally, 5 nodal stations should routinely be examined (2R, 4R, 7, 4L, and 2L). In a retrospective Dutch study involving 387 patients who underwent mediastinoscopy at 1 teaching and 3 nonteaching hospitals, systematic sampling was carried out in only 40% of the cases.³⁵ Similar concerns about the adequacy of mediastinoscopy depending on the experience of the surgeon have been voiced: thoracic surgeons recognize that the yield of mediastinoscopy varies considerably based on training and experience.³⁶ The same concerns may be raised once EUS and especially EBUS are used more widely, as we move beyond just having dedicated enthusiasts perform these exams. In a study of 60 patients who had both mediastinoscopy and EUS-FNA (some by indication and some by random selection), EUS was superior to mediastinoscopy in the examination of paratracheal and subcarinal regions taken together.³⁷ This is not surprising for the subcarinal stations but, interestingly, the sensitivity for lymph node metastases for the right paratracheal

region (more difficult to access with EUS) was 67% for EUS-FNA and 33% for mediastinoscopy, and for the left paratracheal region the results were even better, at 80% and 33%, respectively. This was a small study and the results for 2L and 4L fell just short of statistical significance. More work is clearly needed. Nevertheless, while mediastinoscopy, if done by experienced surgeons, will continue to have a role in the invasive staging of NSCLC, currently the question should be raised as to whether mediastinal staging with mediastinoscopy alone is adequate and, if EUS and EBUS are incorporated into the staging algorithm, which should be done first. In a retrospective study EUS-FNA was performed on 35 patients with biopsy-confirmed negative mediastinoscopies.³⁸ Thirteen patients were found to have malignant N2 or N3 lymph nodes. In an interesting cost-analysis model using Monte-Carlo techniques the authors postulated that if EUS-FNA had been performed initially (rather than mediastinoscopy) an average cost saving of \$11 033 per patient would have resulted. Similar results were obtained by Annema and colleagues³¹ in a study of 107 Dutch patients. Sixteen percent of thoracotomies could have been avoided by using EUS in addition to mediastinoscopy.

Strengths and Limitations of EUS-FNA

EUS can reliably reach lymph node stations 5, 7, 8, and 9 and Soria and colleagues³⁹ have provided a good introduction to the technique in this journal. In the superior mediastinum the trachea is somewhat to the right of the esophagus, so it is therefore often possible to reach left-sided areas of 2 and 4 lymph nodes and, less often, right-sided paratracheal lymph nodes.³⁷ Unlike the trachea, the esophagus is fairly flexible and considerable excursions in a lateral direction are possible so that structures which look relatively remote from the esophagus on a CT scan can often be seen and biopsied during EUS exams, especially if they are significantly larger than 1 cm. In general, however, EUS is most appropriate for evaluation of the posterior inferior mediastinum while mediastinoscopy or EBUS are best for the anterior superior mediastinum. The feasibility of EUS-FNA of aortopulmonary window (subaortic) lymph nodes (station 5) has been thought to be a major advantage of EUS. Evaluation of this station has traditionally required a paramedian mediastinotomy (Chamberlain procedure). A recent single-institution retrospective study has questioned the reliability of EUS to assess para-aortic lymph nodes (stations 5 and 6), however.⁴⁰ EUS-FNA (n=62) was 66% correct in that study whereas video-assisted thoracoscopic surgery in 39 patients was 100% correct. Unfortunately, stations 5 and 6 were analyzed together, so we do not know how many of the false-negative results involved station 6 lymph nodes (which can be reached by EUS only by passage through the aortic arch or descending aorta, a potentially risky procedure). Also, the authors point out that sometimes station 5 and 6 are identified inconsistently during thoracotomy and/or EUS. Selection bias may have also played a role. The number of true negatives in the video-assisted thoracoscopic surgery group was only 3 out of 39 (9%); in contrast, there were 21 true negatives in the EUS group (34%). Prospective studies with particular attention to this lymph node group may help resolve this issue.

EUS can easily sample celiac lymph nodes which cannot be reached by the other mediastinal staging methods. In a recent study an unexpectedly high incidence of celiac lymph node

metastasis (11%) was noted.¹⁰ The importance of celiac lymph nodes has also been reported by others.^{34,41} EUS also has the advantage that left adrenal metastases can be biopsied whereas the right adrenal gland is more difficult to sample.⁴² A topic which will require further work is the utility of EUS-FNA in the restaging of the mediastinum in patients who have undergone chemotherapy and radiotherapy for N2 disease (Figure 2). If the initial mediastinal staging includes a mediastinoscopy, most surgeons try to avoid a repeat mediastinoscopy after radiation treatment. Restaging by PET and CT scanning may help to provide biopsy targets but, as we know, even the PET-negative mediastinum needs to be sampled. EUS-FNA and EBUS-FNA appear to clearly tip the risk-benefit scale in these patients.⁴³

Radial- and Convex-Probe EBUS

The topic of EBUS can be confusing. The literature before 2004 pertains exclusively to radial EBUS, whereas papers addressing convex-probe EBUS, which is also sometimes called curved-linear or linear EBUS, then began to appear.

The ultrasound endoscopes which were first used in the digestive tract are too large for the airways. At roughly the same time when dedicated gastrointestinal ultrasonic endoscopes were developed, miniaturized catheter probes were designed that fit through the working channel of a conventional endoscope or bronchoscope. At the tip of these accessories is a small piezoelectric crystal that is rotated by a mechanical driving unit with frequencies that range from 3.5 to 20 MHz. Typically, catheter probes tend to have higher frequencies (20 MHz), improving image resolution at the expense of penetration depth. The small catheter probes have very little contact with the bronchial wall and air in the bronchial tree transmits sound waves poorly. In the gastrointestinal tract acoustic coupling can be improved by flooding the area of interest with water; in the airways an inflatable balloon surrounding the ultrasound transducer serves a similar purpose. This technique, known as radial-probe EBUS, was first described in 1992.⁴⁴ The Olympus Corporation offers a miniaturized 20 MHz catheter with a balloon which can be inserted through the bronchoscope (UM-BS20-26R, Olympus, Tokyo, Japan).⁴⁵ These catheter probes are useful for the staging of early endobronchial lesions, to assess them for suitability for photodynamic therapy for example. Orientation in the mediastinum and image interpretation are considered difficult and the ACCP recommended in 2003 that trainees perform at least 50 supervised radial EBUS procedures to establish basic competency.⁴⁶ Radial EBUS guidance can also increase the yield of TBNA. Even smaller catheter probes (UM-S20-20R, Olympus) help detect peripheral lung lesions. Radial EBUS can replace fluoroscopy for guiding biopsy procedures. Radial probe EBUS does not, however, allow real-time needle-to-target guidance. Naturally, the 2003 ACCP guidelines do not address the new convex-probe EBUS, which is much different and probably easier to learn. The convex-probe EBUS (XBF-UC260F-OL8, Olympus), introduced into clinical practice by Yasufuku and colleagues⁴⁷ in 2004, is a dedicated ultrasound bronchoscope with a curved array electronically switched ultrasound crystal which has Doppler capability, something that mechanical radial EBUS cannot offer. This type of EBUS device resembles the curved linear array instruments used for EUS-FNA in the gastrointestinal tract but is considerably smaller. Radial

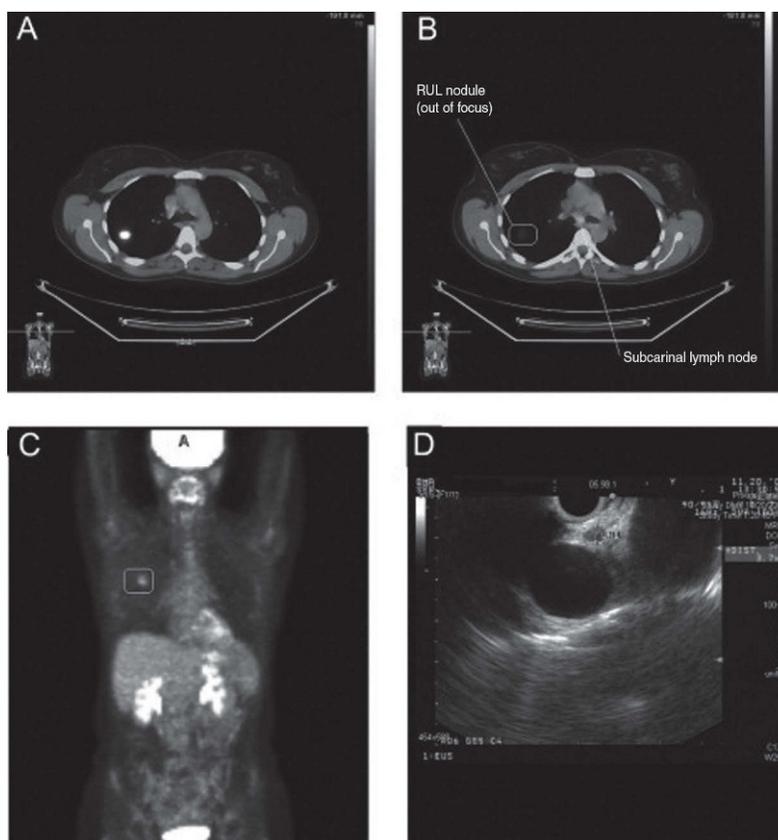


Figure 2. Endoscopic ultrasound (EUS) restaging of non-small cell lung cancer after mediastinoscopy. A, the initial-staging positive emission tomography (PET) scan showing a hot nodule in the right upper lobe (RUL) with a standardized uptake value of 7.1. B, cut of the initial-staging PET scan showing a high degree of glucose avidity in the subcarinal region consistent with lymph node metastasis. C, a restaging PET scan after induction chemotherapy and radiation, showing a reduction in the intensity of the RUL mass and no activity in the mediastinum, consistent with a good response to treatment. D, 2 small aortopulmonary window lymph nodes (3 mm) visible on EUS; the EUS-guided biopsies showed non-small cell lung cancer, however.

scanning does not allow visualization of a TBNA needle as it emerges from the bronchoscope, so the field of view for a specialized TBNA EBUS scope needs to be convex (curved-linear). Power Doppler capability is a useful feature to avoid accidental vessel puncture and the large size of the ultrasound transducer allows for operation of the instrument with no or only minimal balloon inflation. The tip diameter for the convex-probe EBUS bronchoscope is 6.7 mm. Compared to the standard bronchoscope, the instrument handles differently. It is stiffer and bigger, the forward view is oblique, and the white light image is darker. This instrument is, however, ideally suited to evaluate the superior anterior mediastinum; in addition, subcarinal lymph nodes can be accessed. The early experience with this instrument in mediastinal lymph node staging appears very promising, with sensitivities ranging from 92% to 96% in 4 series comprising from 70 to 502 patients.⁴⁷⁻⁵⁰ Herth and coworkers⁵¹ recently published an important study evaluating the utility of EBUS-FNA in patients who have a normal mediastinum according to PET and CT (clinical stage I of lung cancer). Of 97 patients with confirmed NSCLC, apparently in stage I, 9 were found to have metastatic lymph nodes which were discovered by EBUS; 1 was a false negative. All EBUS results were confirmed by thoracotomy.

It appears that convex-probe EBUS is easier to learn than radial-probe EBUS. There are currently no published guidelines about training and credentialing for this technique, but Sheski and Mathur⁵² probably echo the feelings of many when they say

that with a competent mentor, one can become comfortable with convex-probe EBUS after approximately 20 procedures. While the gastrointestinal EUS scopes do not fit into the trachea, it is of course possible to use the convex-probe EBUS in the esophagus to reach mediastinal lymph node stations which are otherwise invisible.⁵³ Institutions which can only afford 1 ultrasound scope may give this consideration.

Complete Medical Mediastinoscopy

EBUS-FNA and EUS-FNA are complementary techniques. EBUS is strongest for the anterior superior mediastinum and EUS has the highest yield in the posterior inferior mediastinum. Some lymph node stations can only be accessed by 1 method and not the other; for example, station 2L, 4L, and 3 are hard or impossible to see by EUS. Stations 5 and 8, on the other hand, cannot be biopsied by EBUS. Together, EBUS and EUS cover the entire mediastinum, except possibly station 6, and complete mediastinal staging should be possible with a combination of these 2 procedures (Figure 3). We recently published the results of a study involving 138 patients who underwent TBNA, EUS-FNA, and EBUS-FNA in a single combined session.⁵⁴ The sensitivity of EBUS-FNA was much higher than the sensitivity of bronchoscopy-TBNA, detecting 29 (69%) of the malignant lymph nodes compared to 15 (36%) ($P=.003$). EUS and EBUS in combination had a sensitivity and negative predictive value which was significantly

higher than if either method had been used alone, at 93% (95% CI, 81%-99%) and 97% (95% CI, 91%-99%), respectively. The combination resulted in an estimated increase in sensitivity of 24%. We concluded that EUS and EBUS in combination can achieve almost complete minimally-invasive staging of the mediastinum. Similarly encouraging results using a combined approach have been reported by other authors in smaller series.^{37,55,56}

Revisions in the Lung Cancer Staging System

The current TNM staging system for NSCLC was last revised in 1997. The International Association for the Study of Lung Cancer has assembled a dataset with more than 100 000 entries representing 23 institutions in 12 countries in Europe, North America, and Australasia and proposes some important changes.^{57,58} The main suggestions are in the T and M classification, with N status remaining the same. Tumor size was found to be an important prognostic factor and it was recommended that

the T stage be subdivided based on 5 different size criteria. Survival was better in patients with primary tumors with satellite nodules in the same lobe, and downgrading these patients from T4 to T3 was recommended. Likewise, additional nodules in a different lobe of the ipsilateral lung moved from an M1 designation to T4. Malignant pleural effusion is currently classified as T4 or so-called wet 3B disease, despite the fact that the survival of patients in this group is much more similar to that of metastatic rather than locally advanced disease. It was therefore proposed to move these patients to M1. Furthermore, M status should be split into M1a (metastatic disease confined to the chest) and M1b (extrathoracic metastatic disease) based on the finding that survival is better in those with metastatic disease confined to the thorax. Adoption of these proposed changes in part or fully will not change N staging or, specifically, the recommendations for invasive mediastinal staging.

The Future of Chest Endoscopy

Pulmonologists have traditionally dominated the field of invasive chest diagnostics. Even with the overwhelming evidence supporting the role of EUS-FNA in mediastinal staging, this technique is often not incorporated into staging or diagnostic protocols, even if readily available. This is an observation which has been made in both the United States⁵⁹ and Australia.⁶⁰ The reasons for this are not clear. We hope that this situation will change as respiratory physicians start to embrace EBUS. To paraphrase Annema and Rabe,⁶¹ now the question is not if but how and on which scale and within which time frame EUS will be implemented in the routine practice of pulmonary medicine. EBUS cannot stage the entire mediastinum. Any respiratory physician who wants to do "complete medical mediastinoscopy" will also need to learn EUS-FNA. The current practice of some national referral centers in the United States of scheduling patients to have consecutive EUS-FNA and EBUS-FNA done by a gastroenterologist and a pulmonologist will be almost impossible to implement on a large scale in the community. Not surprisingly, respiratory physicians have expressed an interest in learning EUS.^{32,62,63} Fritscher-Ravens and her group,³² for example, trained several pulmonologists in their unit in Germany in how to perform transesophageal EUS-FNA. Granted, the situation in Germany is different since their so-called general internist has 6 years of postgraduate training and will often be competent to do colonoscopies, upper endoscopies and bronchoscopies. In contrast these procedures are neatly divided up among the subspecialties in the United States. Bronchoscopists can learn how to do transesophageal FNA, but EUS experts can also learn EBUS. If we want our patients to benefit and we are also to accelerate the implementation of EUS and EBUS for mediastinal staging, it should not really matter where we are coming from. However, to be equitable, the skill transfer has to be bilateral. In other words, let us imagine a situation in which endosonographers help their pulmonary colleagues to get started with EBUS by teaching them how to do EUS-FNA through the esophagus, while the respiratory physicians train their EUS colleagues in how to do EBUS through the airways. That gastroenterologists can learn how to do EBUS has already been shown.⁶⁴ In less than a decade a cadre of experienced chest endoscopists would be created and everybody would benefit. Maybe we will come full circle and the specialty of esophago-bronchology will experience a revival.

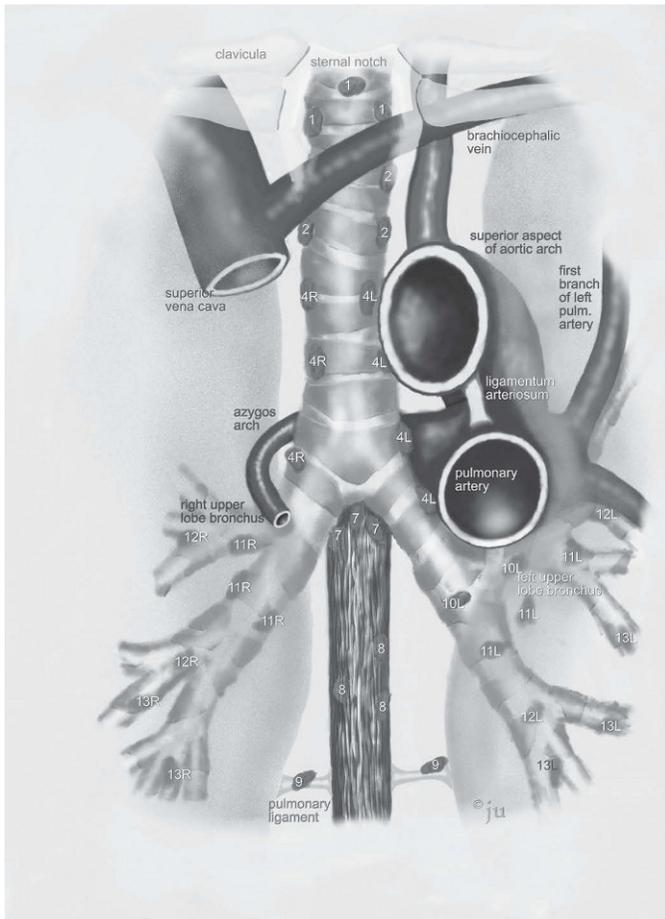


Figure 3. The reach and roles of endoscopic and endoscopic bronchial ultrasound (EUS and EBUS) procedures and mediastinoscopy. In general, EBUS and mediastinoscopy are superior to EUS in the upper mediastinum. Some station 2 and 4 lymph nodes can be biopsied under EUS guidance provided they are large enough to become visible from the esophagus; this is more likely the case for left-sided stations. Station 7 is common territory for all 3 modalities. In the upper mediastinum EUS can easily reach station 5 (subaortic or aortopulmonary window) lymph nodes and is the only modality of the 3 that can be used in the lower mediastinum to biopsy station 8 and 9 lymph nodes, celiac lymph nodes, and the adrenal glands. Artist: Jens Uhdre.

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