a lot by doing this study, because we get direct feedback from the cytopathologist, and by doing that, we have been able to modify how we sample our lymph nodes so that we can submit a better sample.

Dr Cooper. Clearly, the significance that a person attaches to the presence or absence of mediastinal lymph node involvement will determine how vigorously he or she attempts to pursue the goal that you achieved. What is your current policy on patients with known or suspected lung cancer? How important is it to you to obtain accurate mediastinal node sampling before thoracotomy, and what do you do with that information?

Dr Yasufuku. I think accurate mediastinal lymph node staging is an important issue that affects patient outcome. In our current practice, according to the results of our study, when patients have a clinical N2 disease based on imaging, we would start out the invasive staging with endobronchial ultrasound. We not only sample 1 lymph node station, but, as I showed in this study, we typically do systematic lymph node sampling, not just going after 1 lymph node. Even if we do find metastasis in 1 lymph node, we would also check the other mediastinal lymph node stations. If we do confirm the disease and it is resectable, we would have the patient undergo induction treatment. I think the beauty about EBUS is that a redo EBUS is typically easier than a redo mediastinoscopy. So we can go back after induction treatment, follow-up on these patients, and actually safely restage the patients. If necessary, we can always do a mediastinoscopy as well.

Dr Cooper. Thank you, and that answered another question that I had. Finally, do you obtain sufficient material for tumor markers, which increasingly is important in directing the neoadjuvant therapy of these patients?

Dr Yasufuku. Sometimes it may be a challenge, but if done in the correct way, we have been able to obtain adequate samples for molecular analysis, such as epidermal growth factor receptor mutation analysis. Regular immunohistochemistry is done routinely by the cytopathologist using the cell block, and the cytopathologist is typically happy with what we submit.

Dr Frank Detterbeck (*New Haven, Conn*). Just a quick comment. I think that EBUS is not EBUS is not EBUS, and mediastinoscopy is not mediastinoscopy. Certainly EBUS as you have done it is different from what many people do; they quickly aspirate 1 node station and that is it, and the same with mediastinoscopy, as Alex Little showed us in the United States in 2005, where 50% don't even sample a single node. You have done a very systematic staging. Furthermore, video mediastinoscopy is better than old-fashioned mediastinoscopy. It is important for us to consider these results in this context as we figure out how to implement them more broadly.

Dr Bryan Meyers (*St Louis, Mo*). I enjoyed your article. It is going to be an excellent contribution to the literature. The only area where either of your treatment arms diverged from standard clinical care was the use of a different needle at each site. Equipment from Olympus was donated for the trial, and so it was okay. We don't have that same advantage during a case of routine clinical care. How do you think that discrepancy might affect the interpretation or generalizability of your results, and could you justify why you chose to do that?

Dr Yasufuku. Thank you for raising an important issue. The reason why we chose to use different needles was because we wanted to eliminate contamination. I think we should ideally use different needles for different lymph node stations, especially when you do not have ROSE cytology where the cytopathologists can tell you if the needle you used was positive for cancer or not. We always start out our sampling from the N3 nodes and then work our way to the N2 and N1 nodes. Needles cost approximately \$80 to \$100 each, but to prevent contamination and possible upstaging, I think it is important to use different needles.

If you have ROSE cytologic evaluation and the lymph nodes are found to be negative for malignancy, it may be possible to use the same needle after washing the needle properly; however, there have been no studies looking at the use of the same needle for different lymph node stations and the impact on the final diagnosis.

COMMENTARY

Mediastinoscopy: An obsolete procedure?

Valerie W. Rusch, MD

From the Memorial Sloan-Kettering Cancer Center, New York, NY.

Disclosures: Authors has nothing to disclose with regard to commercial support.

Received for publication Sept 28, 2011; accepted for publication Oct 12, 2011.

Address for reprints: Valerie W. Rusch, MD, Chief, Thoracic Surgery Service Memorial Sloan-Kettering Cancer Center 1275 York Avenue New York, NY 10065 (E-mail: ruschv@mskcc.org).

J Thorac Cardiovasc Surg 2011;142:1400-2

0022-5223/\$36.00

Copyright © 2011 by The American Association for Thoracic Surgery

doi:10.1016/j.jtcvs.2011.10.017

For approximately 50 years, mediastinoscopy has been a pivotal part of the pretreatment staging of lung cancer.¹ At one time, respected thoracic surgical groups in North America and Europe considered mediastinoscopy mandatory before proceeding to resection of a non-small cell lung cancer (NSCLC). However, during the past 30 years, improvements in noninvasive imaging modalities, first computed tomography and then positron emission tomography,

led to more selective use of mediastinoscopy focusing on patients with enlarged or hypermetabolic mediastinal lymph nodes.^{2,3} During the past decade, the technology for endobronchial ultrasound (EBUS) has become widely available, and EBUS-guided transbronchial needle aspiration (EBUS-TBNA) of hilar and mediastinal lymph nodes has been shown to be feasible, safe, and accurate.⁴ Last year, a prospective multicenter European trial reported randomizing 241 patients with NSCLC who had enlarged or hypermetabolic mediastinal lymph nodes to surgical mediastinal staging (predominantly cervical mediastinoscopy) or staging by endosonography, combined EBUS, and esophageal ultrasound (EUS) plus surgical staging. All patients found to have benign mediastinal lymph nodes then underwent resection and mediastinal lymph node dissection.⁵ The combined strategy of endosonography and surgical staging resulted in greater sensitivity for mediastinal nodal metastases and fewer inappropriate thoracotomies than surgical staging alone.

In this issue of the *Journal*, Yasufuku and colleagues⁶ from the University of Toronto report a prospective controlled trial of EBUS-TBNA compared with mediastinoscopy for the staging of NSCLC. During a 4-year period from 2006 to 2010, 153 eligible patients with known or suspected potentially resectable NSCLC underwent EBUS-TBNA of the mediastinal lymph nodes followed immediately by cervical mediastinoscopy with systematic biopsies of subcarinal and bilateral paratracheal lymph nodes. If frozen sections on the nodal biopsies were benign, patients went on to surgical resection of the tumor. There were no complications related to EBUS-TBNA, whereas 4 patients experienced minor complications from the mediastinoscopy. There were no significant differences between EBUS-TBNA and mediastinoscopy in determining the true pathologic N stage, and the authors conclude that EBUS-TBNA can replace mediastinoscopy for pre-resection staging in patients with potentially resectable NSCLC. Does this study establish a new standard of care and render mediastinoscopy obsolete?

It is important to understand that this study sets the highest possible bar both for the quality of mediastinoscopy and for EBUS-TBNA. The University of Toronto group has a long tradition of excellence in mediastinoscopy, and the systematic approach in this trial of biopsying all accessible lymph node stations in the paratracheal and subcarinal regions reflects that tradition. The leadership of Dr Yasufuku, who is internationally recognized for helping to develop EBUS-TBNA along with his colleagues,^{7,8} enabled all the participating surgeons to perform this procedure with consistent expertise. A minority of thoracic surgeons worldwide are currently capable of performing both mediastinoscopy and EBUS-TBNA at this level. An additional key technical aspect of EBUS-TBNA in this study is the use of rapid on-site evaluation of needle aspirates by

a cytopathologist or cytotechnologist. Such support from pathologists is critical to determining the number of aspirates required for successful diagnosis and can rightfully be considered standard care. A consistent approach to obtaining a minimum of 3 aspirates and of using separate aspiration needles for each lymph node station also optimized diagnostic yield and prevented specimen cross-contamination. Finally, as discussed by the authors, general anesthesia and a laryngeal mask airway provide a quiet operative field and maximize the ability to biopsy all paratracheal lymph node stations. EBUS-TBNA also has the advantage of allowing biopsy of N1 lymph nodes (interlobar and peribronchial) not accessible by mediastinoscopy and thus identifying patients with earlier stage disease who may benefit from induction chemotherapy. Under these ideal conditions and in the hands of surgeons expert in both procedures, it is certainly reasonable to state that EBUS-TBNA can replace mediastinoscopy for staging potentially resectable NSCLC.

So what remains the role of mediastinoscopy? This procedure will likely still be necessary for diseases for which a larger sample is needed for definitive diagnosis, including various infectious or inflammatory conditions, small cell lung cancer, and lymphoma. As the authors point out, very small lymph nodes less than 5 mm are not reliably biopsied by EBUS-TBNA. Although such nodes are usually benign in patients with NSCLC, they may require mediastinoscopy for biopsy if other diseases are suspected. In addition, as molecular profiling becomes increasingly pivotal in the management of thoracic malignancies, it will be important to determine whether EBUS (or EUS)-TBNA samples are sufficient for this purpose or whether mediastinoscopy is still needed under some circumstances.

It is critical that thoracic surgeons develop expertise in EBUS-TBNA and retain expertise in mediastinoscopy. As suggested by the randomized European trial, expertise in EUS-TBNA is also highly desirable because EUS provides access to nodal stations (levels 5, 6, 8, and 9) that cannot be reached by EBUS or mediastinoscopy. While EBUS-TBNA is rapidly gaining popularity in the pulmonary medicine community and EUS is frequently performed by gastroenterologists, thoracic surgeons are uniquely positioned to offer patients the most efficient approach to diagnosis and staging by performing any one or any combination of these 3 procedures in a single trip to the operating room. The choice of procedure should be based on what offers the patient the best disease management, not on the specialty of the physician who happens to be seeing that patient. Our thoracic surgical residency training programs need to provide training in all of these techniques. Indeed, changes in thoracic surgical index case requirements to include both mediastinoscopy and EBUS are currently being considered by the American Board of Thoracic Surgery and the Thoracic Surgery Residency Review Committee. Practicing thoracic surgeons already proficient in mediastinoscopy

should move to gain experience in EBUS and EUS-TBNA through hands-on skills courses. To disseminate expertise in EBUS and EUS-TBNA, our thoracic surgical societies should mount an intensive effort to provide skills courses during the next few years. Mediastinoscopy is not yet obsolete, but its role is diminishing and evolving. It is critical that we as thoracic surgeons understand this and adopt new technologies to the benefit of our patients.

References

1. Hammoud ZT, Anderson RC, Meyers BF, Guthrie TJ, Roper CL, Cooper JD, et al. The current role of mediastinoscopy in the evaluation of thoracic disease. *J Thorac Cardiovasc Surg.* 1999;118:894-9.
2. Detterbeck FC, Jantz MA, Wallace M, Vansteenkiste J, Silvestri GA. The American College of Chest Physicians. Invasive mediastinal staging of lung cancer: ACCP evidence-based clinical practice guidelines (2nd edition). *Chest.* 2007; 132(3 Suppl):202S-20S.
3. Meyers BF, Haddad F, Siegel BA, Zoole JB, Battafarano RJ, Veeramachaneni N, et al. Cost-effectiveness of routine mediastinoscopy in computed tomography- and positron emission tomography-screened patients with stage I lung cancer. *J Thorac Cardiovasc Surg.* 2006;131:822-9.
4. Ernst A, Eberhardt R, Krasnik M, Herth FJF. Efficacy of endobronchial ultrasound-guided transbronchial needle aspiration of hilar lymph nodes for diagnosing and staging cancer. *J Thorac Oncol.* 2009;4:947-50.
5. Annema JT, Van Meerbeeck JP, Rintoul RC, Doooms C, Deschepper E, Dekkers OM, et al. Mediastinoscopy vs endosonography for mediastinal nodal staging of lung cancer: a randomized trial. *J Am Med Assoc.* 2010;304: 2245-52.
6. Yasufuku K, Pierre A, Darling G, de Perrot M, Waddell T, Johnston M, et al. A prospective controlled trial of endobronchial ultrasound guided transbronchial needle aspiration compared to mediastinoscopy for mediastinal lymph node staging of lung cancer. *J Thorac Cardiovasc Surg.* 2011;142:1393-440.
7. Yasufuku K, Chiyo M, Sekine Y, Chhajed PN, Shibuya K, Iizasa T, et al. Real-time endobronchial ultrasound-guided transbronchial needle aspiration of mediastinal and hilar lymph nodes. *Chest.* 2004;126:122-8.
8. Yasufuku K, Nakajima T, Motoori K, Sekine Y, Shibuya K, Hiroshima K, et al. Comparison of endobronchial ultrasound, positron emission tomography, and CT for lymph node staging of lung cancer. *Chest.* 2006;130:710-8.