Transesophageal pulmonary nodule biopsy using endoscopic ultrasonography

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Objective: Parenchymal pulmonary nodules located in proximity to the mediastinum, vertebral column, major vessels, or behind the heart can be technically challenging and dangerous to biopsy using traditional image-guided techniques. Endoscopic ultrasound-guided fine needle aspiration (EUS-FNA) can be used to access some of these difficult to reach lesions. The purpose of the present study was to report our experience with this technique in a consecutive cohort of selected patients.

Methods: This was a retrospective cohort study. Eligible patients were identified from a prospective database. A transesophageal approach under real-time EUS guidance was performed using a 22-gauge needle. All patients underwent postprocedural chest radiography and were followed up at 30 days.

Results: During a 31-month period, 55 patients underwent EUS-guided lung biopsy. Confirmatory visual correlation of nodule localization within the lung parenchyma between computed tomography and EUS was possible in 100% of cases. The lung nodule distribution was 41.5% right upper lung, 18.9% right lower lung, 28.3% left upper lung, and 11.3% left lower lung. Histologic and cytologic sampling was adequate in 52 of the 55 procedures (94.5%). In all patients with adequate biopsy sampling, accurate pathocytologic diagnoses of the target parenchymal nodules were obtained. The accuracy and sensitivity of EUS-FNA were both 94.5% and consistent with the diagnosis on pathologic resection or clinical progression of disease, or both. No morbidity resulted from the procedure nor was observed at 30 days.

Conclusions: EUS-FNA of parenchymal pulmonary nodules is safe and accurate and allows for biopsy of perimediastinal lung lesions not attainable using traditional techniques. (J Thorac Cardiovasc Surg 2014;148:850-5)

Lung cancer is the leading cause of cancer death in the United States, with an estimated incidence of 224,210 new cases in 2014.[1] Patients with non–small cell lung cancer (NSCLC) typically present with a lung nodule or mass that might or might not be symptomatic. Recently, the National Lung Screening Trial has shown that screening with low-dose computed tomography (CT) is efficacious and associated with reduced mortality.[2] Thus, lung cancer screening is expected to increase the number of patients presenting for diagnostic evaluation of a pulmonary nodule or mass. In certain patients, tissue for pathologic analysis is required to rule out or rule in malignancy.

Many options exist for obtaining samples from the parenchymal lung nodule for pathologic analysis, including transthoracic image-guided needle aspiration (TTNA), transbronchial biopsy (TBNA), endobronchial ultrasound-guided biopsy, navigational bronchoscopic guidance biopsy, and thoracoscopic or open lung biopsy. Parenchymal pulmonary nodules located in proximity to the mediastinum, in front of the vertebral column, in proximity to major vessels, or behind the heart can be technically challenging and dangerous to biopsy using traditional image-guided techniques. Endoscopic ultrasound-guided fine needle aspiration (EUS-FNA) has become common for diagnosing mediastinal lymph nodes in lung cancer; however, its utility in biopsying parenchymal pulmonary nodules is not known. The present study reports on the largest reported experience with transesophageal needle aspiration of lung nodules using real-time EUS guidance.

METHODS

The study was a retrospective cohort study using a prospective interventional endoscopy research database. Patients presented to the CHUM Endoscopic Tracheobronchial and Oesophageal Center in the Division of Thoracic Surgery at the Centre Hospitalier de l'Université de Montréal during a 31-month period with a lung mass suspicious for either a primary or secondary neoplasm of the lung. These patients had undergone attempts at lung biopsy using traditional techniques that were unsuccessful at obtaining a diagnosis, were not eligible for traditional lung nodule

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Abbreviations and Acronyms

CT = computed tomography
EUS = endoscopic ultrasound
EUS-FNA = endoscopic ultrasound-guided fine needle aspiration
NSCLC = non–small cell lung cancer
TBNA = transbronchial biopsy
TTNA = transthoracic image-guided needle aspiration

biopsy owing to anatomy or nodule location, or traditional techniques for lung nodule biopsy were thought to be too dangerous to attempt. All patients undergoing transesophageal biopsy of an intraparenchymal lung lesion using real-time EUS during the study period were included. The aim of the present study was to evaluate the rate of successful tissue sampling, the accuracy of the diagnostic test, and safety.

The institutional review board at the Research Center of the Centre Hospitalier de l'Université de Montréal approved the electronic prospective database used for the present study and approved this trial. Patient consent was obtained for entry into the prospective database; the institutional review board granted a waiver for individual patient consent for the present retrospective review.

All patients had undergone a standard diagnostic evaluation of their lung lesion with a history, physical examination, and standard imaging studies, including CT of the chest and upper abdomen with intravenous contrast and 5-mm cuts. Positron emission tomography scans were performed in patients with a suspicion for NSCLC. Positron emission tomography was performed from the skull base to the mid-thigh level. The maximum standardized uptake value of the primary and each suspicious lymph node station was determined. The clinical TNM stage was recorded. In certain patients, a biopsy was desirable for treatment planning. Such patients included those with a history of a treated malignancy, multiple comorbidities who were at high risk for lung resection, and those considered for stereotactic body radiotherapy. In addition, patients who met the criteria for invasive mediastinal staging according to the most recent American College of Chest Physician's guidelines were included if an EUS-guided lung biopsy had been undertaken in conjunction with their staging procedure.[3] Patients with an endobronchial component were excluded, because biopsy of the lesion was undertaken transbronchially. The data from all patients were reviewed for the possibility of a transthoracic or transbronchial needle biopsy by radiologists, pulmonologists, and thoracic surgeons. For all patients, these procedures had either been attempted and found to be nondiagnostic or were not deemed safe owing to the anatomy.

EUS Technique

A convex probe EUS scope was used to perform real-time transesophageal needle biopsy (EUS Linear Scope, GF-UC140P-AL5; Olympus America Inc, Center Valley, Pa). A dedicated 22-gauge needle (ECHO-1-22; Cook Medical Ireland Ltd, Limerick, Ireland) was used to perform all EUS needle biopsy procedures under real-time ultrasound guidance. No core needle biopsies were used. No transvascular biopsies were performed. The smears were air dried and fixed on a slide. Additional samples were preserved in Cytolyt solution for cell block preparation. We performed as many passes as needed until satisfied with the gross appearance of the specimen. On average, this required 2 to 4 passes. Rapid on-site evaluation by a cytopathologist was not performed. An upright chest radiograph was obtained in the recovery area after the procedure to rule out iatrogenic pneumothorax. Conscious sedation was used for all procedures.

Definitions and Statistical Methods

A negative result was defined as a lung nodule labeled as benign by EUS and an adequate needle aspiration that identified the absence of tumor cells. A false-negative result was defined as the subsequent identification of malignancy, by either resection or biopsy using another method, within a mass deemed negative for malignancy by EUS-FNA. The efficacies (accuracy, sensitivity, and negative predictive value) of these tests were computed using standard definitions.

RESULTS

From October 2010 to May 2013, 1165 patients underwent combined endosonographic evaluation of biopsy-proven lung cancer or highly suspicious pulmonary lesions using combined endobronchial and endoesophageal ultrasound. Of the 1165 patients, 55 underwent planned transesophageal real-time ultrasound-guided biopsy of a suspicious lung lesion. The demographic data for these patients are listed in Table 1. The remaining 1110 patients did not undergo transesophageal lung biopsy. Therefore, no patient had transesophageal biopsy planned that was not attempted owing to anatomic constraints. All patients underwent CT of the chest and upper abdomen with $\geq$5-mm collimated cuts.

In all patients, the lesion was visualized using ultrasonography and correlated with the suspicious lesion on the CT scan. The distribution of the location for all the lesions is listed in Table 1, with the right and left upper lobes the most common location for the lesions in the present series. Unsurprisingly, all the lesions were located within the inner third of the thoracic cavity, making access by way of the esophagus feasible.

A diagnostic sample was obtained from 52 of the 55 patients, for a diagnostic yield of 94.5%. In all patients with adequate biopsy sampling, an accurate pathocytologic diagnosis of the target parenchymal nodules was obtained. The accuracy and sensitivity of EUS-FNA were both 94.5% and was consistent with the diagnosis on pathologic resection or clinical disease progression, or both. The distribution of the diagnoses is listed in Table 2. NSCLC was the most common diagnosis in the present series. In all 3 patients with a nondiagnostic sample, additional pathologic analysis was obtained in the form of anatomic lung resection (2 pneumonectomy and 1 lobectomy). In all 3 patients, the final pathologic examination confirmed the presence of NSCLC. No negative results were found, and all diagnostic results yielded a diagnosis of malignancy. Therefore, the prevalence of malignant disease in the present series was 100%.

The nodule volume on EUS compared with that on CT scans had a Pearson product-moment correlation coefficient of 0.954 and Student t test result of 0.044. The diagnostic accuracy was unaffected by tumor phenotype between NSCLC and small cell lung cancer.

No patients had either pneumothorax or new pleural effusion on the postprocedural chest radiograph. No immediate

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