Localization of the Metastatic Site Within a Lymph Node Using Endobronchial Elastography

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Endobronchial elastography is a novel imaging technology which visualizes the relative stiffness of the targeted tissue. Endobronchial elastography can be used for differentiating malignant and benign lymph nodes during nodal staging in patients with lung cancer. Another possible utility of endobronchial elastography would be targeting high-risk area within the intrathoracic lymph node. During nodal staging using endosonographic technology, a false negative result was known as a limitation of needle biopsy modality that could be caused by the micrometastasis within the lymph node. We report the identification of mediastinal lymph node metastasis in a patient with squamous cell carcinoma by visualization of the metastatic site using endobronchial elastography.

Endobronchial elastography visualizes the suspicious area as deep blue.

Keywords: Endobronchial ultraasound-guided transbronchial needle aspiration, Elastography pain, Non-small cell lung cancer, Lymph node metastasis
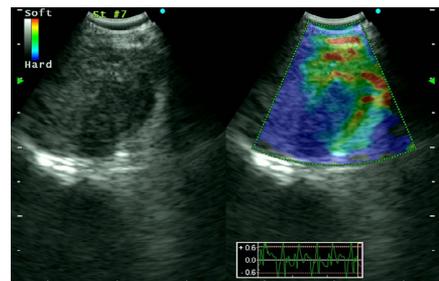
Central Message

We report a case with pulmonary squamous cell carcinoma in which micrometastasis in the mediastinal lymph node was identified by visualization of the metastatic site using endobronchial elastography.

BACKGROUND

Elastography is a strain imaging technique that assesses tissue stiffness and visualizes the distribution of stiffness in the region of interest.[1] Tissue stiffness is estimated by measuring the strain of the tissue in response to mechanical stress, either local compression or vibration. We can calculate the tissue stiffness to measure the amount of change before and after the region of interest is compressed. The feedback on tissue stiffness is converted into a color-coded image and displayed in color on an ultrasound image; areas of stiffness can, for example, appear blue and soft areas red.[1] Endobronchial elastography can be used for differentiating between malignant and benign lymph nodes during nodal staging in patients with

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lung cancer,[2] and is expected to be an alternative to transbronchial needle aspiration (TBNA) under endobronchial ultrasound (EBUS). Another possible application of endobronchial elastography would be targeting the metastatic region within each examined lymph node.[3] During nodal staging using endosonographic technology, needle biopsy sometimes yielded false-negative results, which could be caused by the micrometastasis within the lymph node.

CASE REPORT

A 77-year-old man presented with an abnormal 3.3 × 2.2 cm mass in his right lower lobe with subcarinal lymphadenopathy on chest computed tomography (CT). The subcarinal lymph node (3.5 × 1.7 cm on chest CT) showed an increased uptake of FDG (maximum standardized uptake value = 5.07) on PET-CT; thus, nodal metastasis was suspected. EBUS-TBNA was performed for both the diagnosis of lung cancer and nodal staging. An EU-ME2 Premier ultrasound scanner (Olympus, Tokyo, Japan) was used in combination with a conventional EBUS scope (BF-UC260FW, Olympus). An enlarged subcarinal lymph node of 2.5 × 2.1 cm in size was recognized on B-mode imaging, and showed no signs of central hilum or central necrosis (Fig. 1A). The lymph node was marginally metastatic with a small low-echoic region at the periphery (Fig. 1B). Endobronchial elastography showed the suspicious region as a deep blue area (relatively stiffer area); the other area
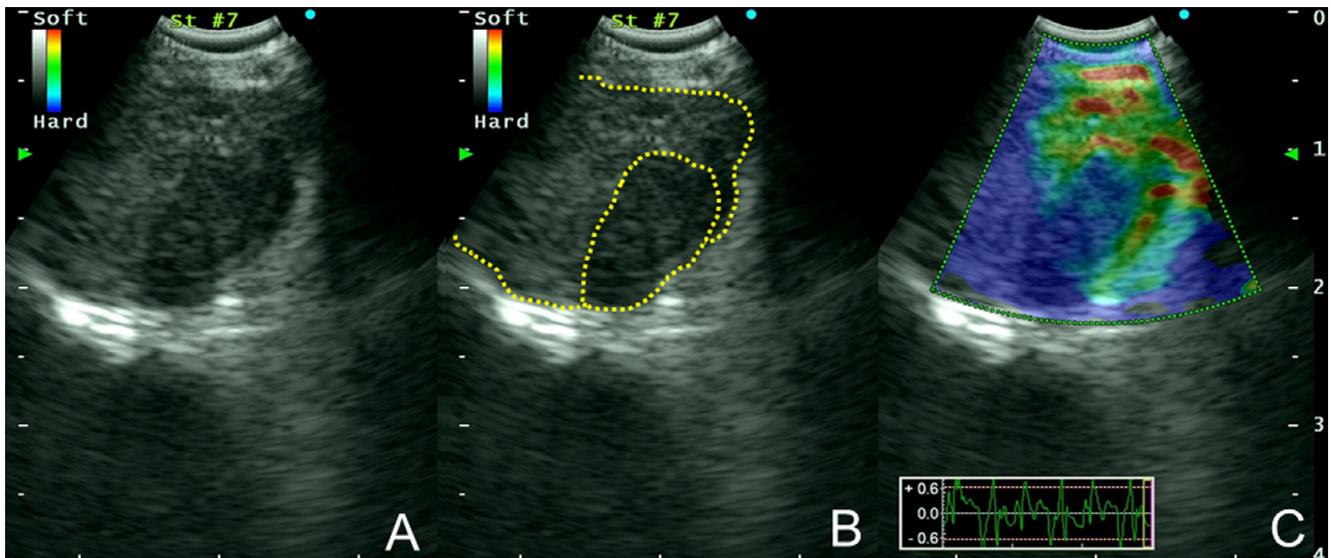
Figure 1. B-mode images and an endobronchial elastography image. The B-mode image showed a subcarinal lymph node of 2.5 × 2.1 cm in size (A), with a suspicious low-echoic region with a border within the node (B). Endobronchial elastography visualizes the suspicious area as deep blue; the surrounding area was shown as green or red (C). (Color version of figure is available online at http://www.semthorcardiovascsurg.com.)

appeared green or red (relatively softer areas; Fig. 1C). First, TBNA of the center of the targeted node, which was adjacent to the suspicious region, was performed (Fig. 2A). A rapid on-site evaluation showed normal cytology (Fig. 2B). Next, another sample was obtained from the suspicious area (Fig. 2C), and a rapid on-site

evaluation was positive for malignant cells. Squamous cell carcinoma was histologically confirmed (Fig. 2D).

DISCUSSION

EBUS-TBNA is one of the "best first" modalities for nodal staging of lung cancer due to its minimal invasiveness and high diagnostic yield.[4] However, sonography-guided needle biopsy techniques have a relatively high false-negative rate (approximately 10%) in comparison to surgical biopsy or dissection. One of the reasons for this is that the capability of EBUS-TBNA to detect micrometastasis within targeted lymph nodes is limited. Tumor cells in the lymphatic drainage flow into lymph nodes through the peripheral sinus, and nodal metastasis and invasion usually occur on the peripheral side of the lymph node. We often encounter micrometastasis in enlarged lymph nodes that predominantly consist of reactive lymphocytes. In such cases, EBUS-TBNA targeting the center of the lymph node must yield a false-negative result. Endobronchial elastography, a novel semiqualitative and semiquantitative imaging technology, enables the easier localization of the metastatic area within each targeted lymph node during EBUS-TBNA and would be useful for controlling the needle to the most suspicious area during EBUS-TBNA. From our previous experience using our criteria,[1] the sensitivity and specificity for predicting metastatic disease were 0.81 and 0.85. Endobronchial elastography would be helpful in the diagnosis of cases with unevenly distributed metastasis within a lymph node, without any additional cost. Additionally, according to the current guideline, additional surgical biopsy is recommended in cases in which TBNA yields a negative result, especially in cases that are deemed radiologically suspicious. Therefore, the technology
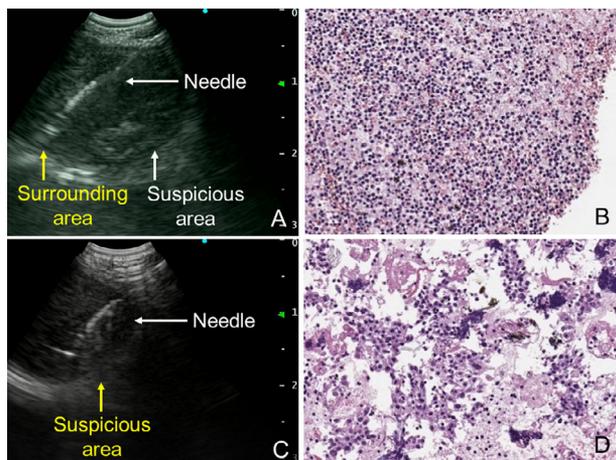
Figure 2. B-mode images of the biopsy needles, and the histopathologic examination of the histologic core. The first sample was obtained from the center of the targeted node, which was visualized as the surrounding area (A). A rapid on-site evaluation (ROSE) revealed normal lymphocytes; this was confirmed by a histologic examination (hematoxylin and eosin staining; original magnification, ×400) (B). The second sample was obtained from the suspicious area (C). A ROSE revealed that it was positive for malignant cells. Squamous cell carcinoma was histologically confirmed (hematoxylin and eosin staining; original magnification, ×400) (D).

may reduce patients who required additional surgical biopsy with false-negative result of TBNA.

Although there have been a number of reports on differentiating between benign and malignant nodes, few studies have discussed the identification of the metastatic area within a targeted lymph node.[5] Endobronchial elastography is a technique that is easy to perform and that enables the visualization of the metastatic area. It may also contribute to the management of lung cancer by improving the accuracy of nodal staging.

Our limitation of this study is the only single-case report for showing availability of elastography; thus, we are continuing to collect clinical cases to show the utility of endobronchial elastography during EBUS-TBNA.

We obtained the written consent to obtain and use the clinical information for medical presentation and publication prior to the performance of EBUS-TBNA.

SUPPLEMENTARY MATERIAL

The following is the supplementary data to this article:

Video 1. The B-mode image showed a subcarinal lymph node of 2.5 x 2.1 cm in size, with a suspicious low echoic region with a border within the node. Endobronchial elastography visualize the suspicious area as deep blue; the surrounding area was shown as green or red. The first sample was obtained from the center of the targeted node, which was visualized as the surrounding area. A rapid on-site evaluation (ROSE) revealed normal lymphocytes. The second sample was obtained from the suspicious area. A ROSE revealed that it was positive for malignant cells.

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