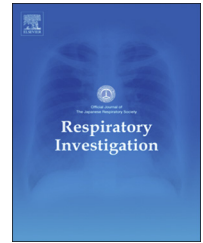




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Combination of virtual bronchoscopic navigation with conventional transbronchial needle aspiration in the diagnosis of peribronchial pulmonary lesions located in the middle third of the lungs



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ABSTRACT

Background: Endobronchial ultrasound-guided transbronchial needle aspiration (EBUS-TBNA) is frequently applied to the diagnosis of central airway lesions, and endobronchial ultrasound with a guide sheath (EBUS-GS) is mainly used for the diagnosis of peripheral pulmonary lesions. However, there remains an unmet need to improve the diagnostic yields for peribronchial pulmonary lesions located along the secondary/tertiary and fourth/fifth bronchi (the “middle third zone” of the lungs), which neither EBUS-TBNA nor EBUS-GS can easily approach.

Methods: A combination of virtual bronchoscopic navigation (VBN) with conventional TBNA was utilized for the cytological diagnosis of 15 patients with small pulmonary lesions (less than 20 mm in diameter) in the middle third zone between March 2012 and January 2015 in our respiratory institute. The lesions were traced using the VBN system, and then the VBN was operated and guided by the vision of actual bronchoscopy. The TBNA site was determined by VBN, and the specimens were obtained using conventional TBNA under X-ray fluoroscopy. The diagnosis was made based on the cytological findings of the specimens.

Results: Adequate specimens were obtained in 12 (80.0%) of the cases through the novel technique of combining TBNA with VBN in bronchoscopic examinations. Seven out of the ten malignant cases (70.0%) were definitely diagnosed by this procedure. No adverse effects were experienced, except for an acceptable amount of bleeding.

Conclusions: The combination of VBN with conventional TBNA was advantageous and safe for the cytological diagnosis of small peribronchial pulmonary lesions in the middle third zone of the lungs.

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1. Introduction

Recent advancements in bronchoscopic technology and computed tomography (CT) imaging have led to remarkably improved approaches for the investigation of undiagnosed pulmonary lesions. Endobronchial ultrasonography, virtual bronchoscopic navigation (VBN), and multidetector CT scanners are now available in many respiratory departments. The endobronchial ultrasound-guided transbronchial needle aspiration (EBUS-TBNA) modality is frequently applied to the diagnosis of pulmonary lesions within the central airway, such as lymphadenopathy, mediastinal tumors, and lung lesions located in the proximal third of the lung (Fig. 1) [1]. The endobronchial ultrasound-guide sheath (EBUS-GS) modality is mainly used for the diagnosis of small pulmonary lesions (usually less than 30 mm in diameter) located in the peripheral third of the lung (Fig. 1) [2]. However, EBUS-TBNA cannot reach the lesions located along the segment between the secondary/tertiary and the fourth/fifth bronchi in the middle third of the lungs (referred to as the “middle third zone” in this paper, Fig. 1). Also, even though the lesions can be visualized with EBUS-GS, adequate sample tissues cannot be taken from the middle third zone due to the relatively thick bronchial wall in this area. As a result, the cytopathological diagnosis of pulmonary lesions in the middle third zone remains challenging. Furthermore, CT-guided transthoracic needle aspiration is not applicable for the biopsy of lesions in the middle third zone because the diagnostic yield of this procedure depends on the length of the needle path [3].

Virtual bronchoscopic navigation (VBN) can be used to guide the bronchoscope to peripheral lesions using virtual bronchoscopy images of the bronchial path [4]. The VBN system accurately directs the bronchoscope to lesions in the segmental and subsegmental bronchi, even deeply to the peripheral bronchi. In a multicenter randomized prospective study, Ishida et al. demonstrated a significantly higher diagnostic yield of peripheral pulmonary lesions in the VBN-assisted EBUS group than the non-VBN-assisted EBUS group [2].

Conventional TBNA is thought to be an optimal modality for the diagnosis of small solitary pulmonary nodules [5]. However, a comprehensive review analyzed the performance characteristics of all bronchoscopic modalities, including TBNA, for the diagnosis of suspected lung cancer and reported a diagnostic sensitivity of 34% for the bronchoscopy of peripheral pulmonary lesions with a diameter of less than 20 mm [5]. The authors remarked that recent complementary tools including endobronchial ultrasound and navigation will improve the diagnostic yield of the existing modalities, in particular the use of EBUS for central and peripheral lesions [5]. However, these cannot be applied to lesions in the middle third zone. Technological advances in high resolution and

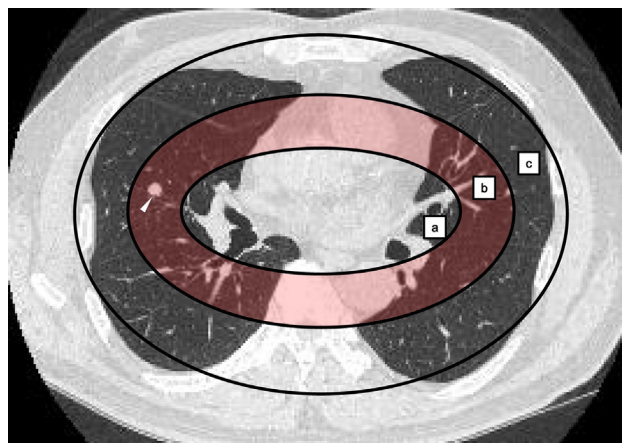


Fig. 1 – Schema of the middle third zone of the lungs. (A) Proximal third zone. (B) Middle third zone (superimposed red background). (C) Peripheral third zone. The white arrowhead shows a peribronchial nodular lesion within the middle third zone of the lung. This chest CT is from Case 3 (described in Table 1).

thin-slice chest CT scanning now enable the excellent identification and illustration of the association of the lesions with the involved bronchus, which provides the opportunity to combine VBN with TBNA to improve the diagnosis of pulmonary lesions with additional cytological evidence.

In this study, 15 patients with peribronchial pulmonary lesions in the middle third zone underwent VBN in combination with conventional TBNA for cytopathological diagnosis. The aim of this study was to evaluate the effectiveness of the novel technique of VBN-assisted TBNA in the diagnosis of peribronchial pulmonary lesions in the middle third zone, which are difficult to diagnose with either EBUS-TBNA or EBUS-GS.

2. Patients and methods

From March 2012 to January 2015, 15 patients from our institute with peribronchial small pulmonary lesions in the middle third zone of the lungs (found on the chest CT images) (Fig. 1) underwent VBN with conventional TBNA for the diagnosis of their lesions. This study was approved by the Ethics Review Board of Shinshu University (Permission number: 2367, Date of approval: 3rd September, 2013). The protocol for the bronchoscopic procedure was in accordance with the principles outlined in the Declaration of Helsinki of the World Medical Association. This protocol was explained to each patient individually before it was performed, and written informed consent was obtained from each patient.

Abbreviations: CT, computed tomography; EBUS-GS, endobronchial ultrasound-guide sheath; EBUS-TBNA, endobronchial ultrasound-guided transbronchial needle aspiration; TBNA, transbronchial needle aspiration; VATS, video-associated thoracic surgery; VBN, virtual bronchoscopic navigation.

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