



Endobronchial ultrasound-guided transbronchial needle aspiration under non-invasive positive pressure for the diagnosis of lung metastasis due to renal cell carcinoma in a patient with respiratory failure

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ABSTRACT

A 65-year-old man with chronic respiratory failure caused by chronic obstructive pulmonary disease, had a pulmonary nodule adjacent to the inlet of right B1 and B3. The patient had undergone a surgery for right renal cell carcinoma and colon cancer 6 years prior. We attempted endobronchial ultrasound-guided transbronchial needle aspiration under non-invasive positive pressure ventilation for diagnosis, with rapid on-site cytology, which was performed without complications. The histological findings revealed lung metastasis involving renal cell carcinoma. Endobronchial ultrasound-guided transbronchial needle aspiration under non-invasive positive pressure ventilation is useful for diagnosing lesions that require access up to the segmental bronchus in patients with respiratory failure.

1. Introduction

Endobronchial ultrasound-guided transbronchial needle aspiration (EBUS-TBNA) is an accurate and safe procedure for the diagnosis of intrapulmonary lesions [1]. The convex probe-EBUS (CP-EBUS) enables access down to the segmental bronchus in most cases. Moreover, lung tumors that are located adjacent to the airway within the range of CP-EBUS can be diagnosed with EBUS-TBNA [2,3]. However, diagnosing a lesion adjacent to the segmental bronchus, which requires vertical access, may be challenging. The range of CP-EBUS depends on the size and angle of bronchus in upper lobe areas. For lesions that require vertical access, a different surgical procedure and computed tomography (CT)-guided needle aspiration biopsy may be appropriate. In contrast, these techniques are unsuitable for patients with chronic respiratory failure, due to the risk of pneumothorax and inability to tolerate general anesthesia. If the range of the CP-EBUS enabled access

to the lesion adjacent to the segmental bronchus, EBUS-TBNA performed under non-invasive positive pressure (NPPV) may be a reasonable, less-invasive approach in patients with chronic respiratory failure, which may enable diagnosis of the lesion.

2. Case report

A 65-year-old man had received 4 years of oxygen therapy (at rest: nasal cannula 3L/min; at exercise: nasal cannula 5L/min) due to respiratory failure related to chronic obstructive pulmonary disease (COPD). His height was recorded as 173cm; weight, 68kg; and body mass index (BMI), 22.7. He had a surgical history of right renal cell carcinoma and colon cancer 6 years prior. His performance status was 2 and his general condition was relatively good. In a periodic medical examination, chest CT showed an enlarged nodule adjacent to the inlet of right B1 and B3 (Fig. 1A and B). Fluoro-deoxyglucose positron emission tomography

Abbreviations: EBUS-TBNA, Endobronchial ultrasound-guided transbronchial needle aspiration; CP-EBUS, convex probe-EBUS; CT, computed tomography; NPPV, non-invasive positive pressure; FDG-PET, Fluoro-deoxyglucose positron emission tomography; CT-NAB, CT-guided needle aspiration biopsy; GS-TBNA, guide sheath transbronchial biopsy needle aspiration; ROSE, rapid on-site cytological evaluation.

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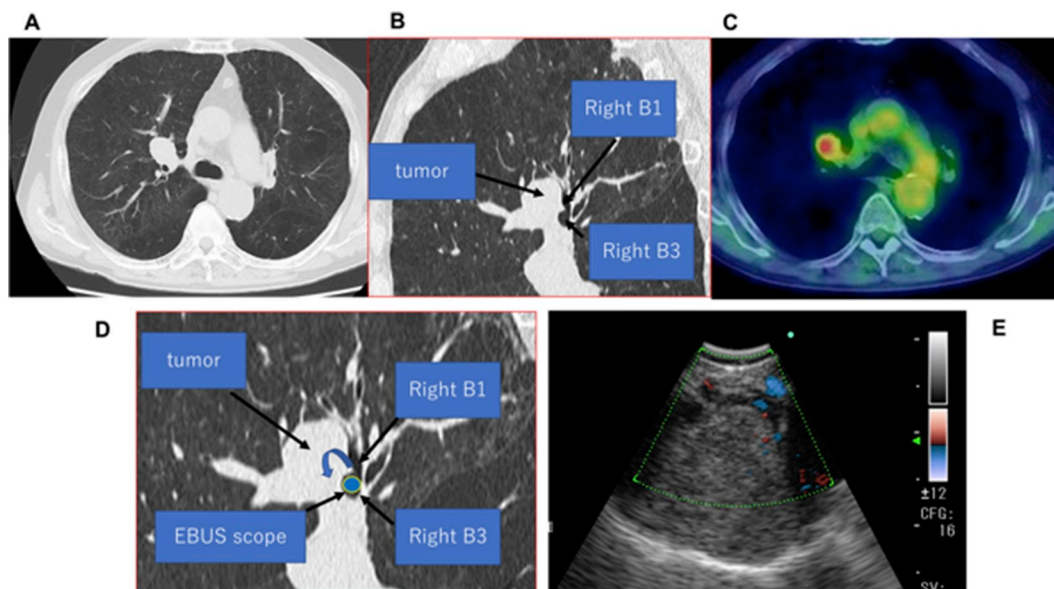


Fig. 1. A, B. Chest computed tomography (CT). CT finding reveals a nodule adjacent to the right B1 and B3 bronchus, which measures 20 mm in the longest diameter.
 C. Fluorodeoxyglucose positron emission tomography (FDG-PET). FDG-PET finding reveals a hypermetabolic lesion in the nodule.
 D, E. The location of Endobronchial ultrasound (EBUS) scope to the target lesion on chest CT and endobronchial ultrasound image of the target lesion.

(FDG-PET) revealed a hypermetabolic lesion in the nodule (Fig. 1C). Therefore, we suspected malignant disease. To diagnose the nodule, we considered three approaches: bronchoscopy, surgery, or CT-guided needle aspiration biopsy (CT-NAB). The patient had poor lung function and chronic respiratory failure. Therefore, we selected a bronchoscopic approach, which included two possible methods: EBUS-TBNA or guide sheath transbronchial biopsy needle aspiration (GS-TBNA). As we were more accustomed to EBUS-TBNA, we selected this procedure. We performed EBUS-TBNA under NPPV because intubation management might cause difficult extubation and a high-flow nasal canula was

unavailable in the endoscopic room. On the day of bronchoscopic examination, blood arterial gas analysis showed that PaO₂ and PaCO₂ under nasal cannula 3L/min were 60.3 and 42.2 torr, respectively. The patient's desaturation was remarkable during exercise and in the supine position. Therefore, we selected EBUS-TBNA under NPPV. Before the procedure, the upper airway was anesthetized with a 2% lidocaine spray, and an intravenous bolus of fentanyl and midazolam was administered. We advanced the ultrasound bronchoscope (BF-UC260FW; Olympus Corporation, Tokyo, Japan) through the mouth into the trachea, with the patient in the supine position under NPPV in

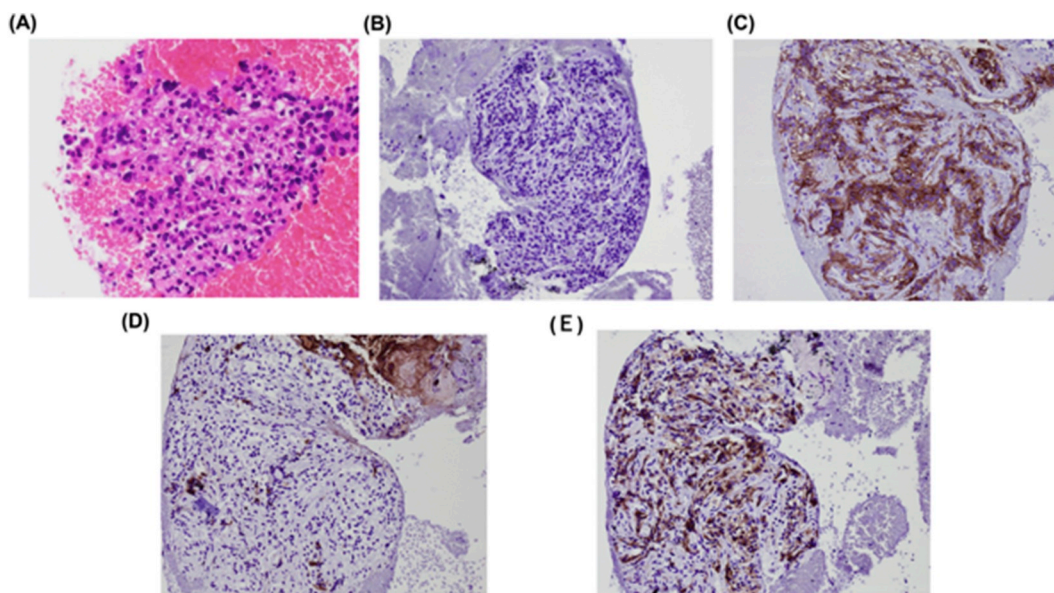


Fig. 2. Histopathological and immunohistochemical findings of the specimen obtained by EBUS-TBNA.
 A. High-power view of the stained and enlarged atypical cells with abundant and largely clear cytoplasm (hematoxylin and eosin stain).
 B. Atypical cells show negative staining for TTF-1.
 C. Atypical cells show positive staining for CD10.
 D. Atypical cells show negative staining for CK7.
 E. Atypical cells show weakly positive staining for CK20.

continuous positive airway pressure mode (pressure, 5 cmH₂O; oxygen saturation, 100%; respiratory rate, 16/min). Because the target lesion in the right upper lobe was adjacent to the inlet of right B1 and B3, we placed the EBUS scope on the inlet of right B3. Advancing the EBUS scope to the inlet of right B3, we inset the EBUS scope into right B3 and rotated the EBUS scope counterclockwise (Fig. 1D). Subsequently, we were able to image the target lesion on the EBUS imaging (Fig. 1E) and punctured the lesion twice with a 21-gauge needle, taking care to avoid puncturing the vessels. Each pass consisted of 10–15 needle thrusts. We then performed rapid on-site cytological evaluation (ROSE). Despite an adequate specimen, the ROSE result was negative. We performed EBUS-TBNA twice and the patient's cough reflex increased after the second procedure without bleeding or desaturation. The patient maintained oxygen saturation of greater than 90% using NPPV throughout the procedure. The duration of the procedure was 20 minutes. After finishing the procedure, we removed NPPV and changed to nasal cannula, after confirming the stability of the respiratory state. Histological and immunohistochemical findings obtained by EBUS-TBNA were compatible with clear cell carcinoma (Fig. 2). The surgical specimen of renal cell carcinoma also showed the same histological pattern. Therefore, we diagnosed the lesion as a postoperative recurrence of renal cell carcinoma, 6 years after nephrectomy. The patient had no other recurrent lesions of postoperative renal cell carcinoma. Subsequently, pazopanib therapy was initiated (800 mg per day). After 3 months of treatment, the lung lesion had improved slightly in chest CT. After 9 months of treatment, the lesion remained only slightly improved in chest CT.

3. Discussion

We have reported a patient with chronic respiratory failure who exhibited postoperative recurrence of renal cell carcinoma in the right upper area of the segmental bronchus, which was diagnosed by EBUS-TBNA under NPPV. EBUS-TBNA is a less-invasive and better-tolerated procedure for the diagnosis of a lesion adjacent to the segmental bronchus [1]; this approach provides sufficient diagnostic specimens for immunohistochemical analyses [2]. However, it has been unclear whether EBUS-TBNA is safe and clinically beneficial for patients with chronic respiratory failure [4]; the choice of this procedure in the present case was based on the patient's comorbidity and performance status. Our patient had COPD as well as histories of colon cancer and renal cell carcinoma. Moreover, based on his performance status, he could adapt to medication therapy, based on the lesion diagnosis. Consequently, we expected that appropriate diagnosis and therapy would be clinically beneficial.

Some previous studies have described the use of flexible bronchoscopy in patients with acute respiratory failure [5]. For bronchoscopy in patients with respiratory failure, a high-flow nasal cannula, NPPV, or invasive positive-pressure ventilation may be used as ventilation support. However, to the best of our knowledge, the most appropriate ventilatory support in chronic respiratory failure remains unknown, and therefore, ventilatory support should be selected on the basis of patients' characteristics [4,6]. In our case, intubation was not performed because of concerns regarding extubation. Moreover, we performed EBUS-TBNA under NPPV because NPPV provided stable tidal volume and reduced

the work of breathing. The utility of this approach may be limited, as it may not reach a lesion in the upper segmental bronchus; if the CP-EBUS is too limited, GS-TBNA could be used under NPPV [7].

Renal cell carcinoma reportedly recurs in 80% of cases within 3 years [8]. Despite this increased frequency of recurrence, we could not diagnose the lesion as recurrence of renal cell carcinoma or colon cancer, or as another lesion, based on chest CT alone. Histology was required to determine the cause of the pulmonary lesion. In chronic respiratory failure patients, surgical procedures and CT-NAB may be not an option for diagnosis and treatment. Furthermore, accurate diagnosis is necessary, including both subtyping and genotyping by minimally invasive procedures. In our case, specimens obtained by EBUS-TBNA were sufficient for immunohistochemical examination.

In conclusion, EBUS-TBNA under NPPV was feasible and useful for treatment of this patient with chronic respiratory failure. In patients with poor lung function, if the CP-EBUS can reach the lesion, EBUS-TBNA under NPPV can be used as an effective procedure for diagnosing a lesion adjacent to the upper segmental bronchus.

Declarations of competing interest

None.

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