


Epidermal growth factor receptor mutation-positive advanced lung adenocarcinoma presenting with acute respiratory failure diagnosed by thin bronchoscope through transnasal route under high-concentration oxygen mask

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Abstract

A 59-year-old woman complained of continuous dyspnea. Computed tomography revealed multiple pulmonary nodules, mildly small enlarged mediastinal lymph nodes and a nodule in the liver segment 8. Her dyspnea worsened with respiratory failure 4 days after presentation. Liver biopsy was not possible as she could not hold her breath; thus, we performed bronchoscopy. For biopsy, the pulmonary nodules with a positive bronchus sign were preferred over the mildly small enlarged mediastinal lymph nodes. Bronchoscopy under non-invasive positive pressure ventilation (NPPV) or high-flow nasal cannula (HFNC) was impossible because of the lack of equipment. Therefore, we biopsied via thin bronchoscope through nasal cavity under a high-concentration oxygen mask. Pathological findings revealed epidermal growth factor receptor mutation-positive lung adenocarcinoma. For patients with respiratory failure who cannot undergo bronchoscopy under NPPV or HFNC, thin bronchoscopy through the nasal cavity under a high-concentration oxygen mask may be clinically useful to prevent hypoxaemia during the procedure

KEYWORDS

acute respiratory failure, bronchoscopy, lung cancer, oxygen mask, transnasal route

INTRODUCTION

In the treatment of advanced lung cancer, a genetic workup is essential to determine the indications for molecular targeted therapy and immunotherapy.¹ Patients with lung cancer initially present with acute respiratory failure because of intrapulmonary tumours or airway obstructions.² Compared with patients without acute respiratory failure, those with acute respiratory failure may not be able to undergo biopsy for the diagnosis of peripheral pulmonary lesions because of the potentially fatal complications associated with biopsy, such as hypoxaemia. Recently, diagnostic bronchoscopy using non-invasive positive pressure ventilation (NPPV) or high-flow nasal cannula (HFNC) has been reported to be safe for

patients with acute respiratory failure.³ However, physicians cannot always utilize these methods during bronchoscopy in all facilities. Herein, we report the case of a patient with acute respiratory failure who was diagnosed with epidermal growth factor receptor (EGFR) mutation-positive advanced lung adenocarcinoma via thin bronchoscope through the nasal cavity under a high-concentration oxygen mask, which was performed to prevent hypoxaemia during bronchoscopy

CASE REPORT

A 59-year-old female patient presented to our hospital with complaints of dyspnea during exercise and prolonged cough

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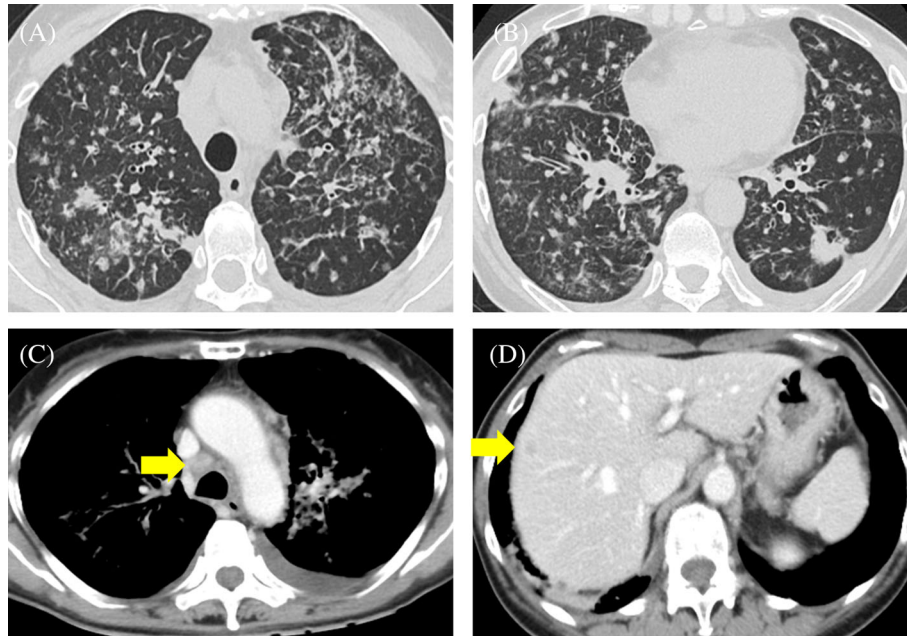


FIGURE 1 (A, B) Chest computed tomography showing multiple nodules on the bilateral lung area as well as left pleural effusion. (C) Chest computed tomography revealing slightly enlarged mediastinal lymph nodes (arrow) and left pleural effusion. (D) Abdominal computed tomography showing a nodule in the liver segment 8 (arrow)

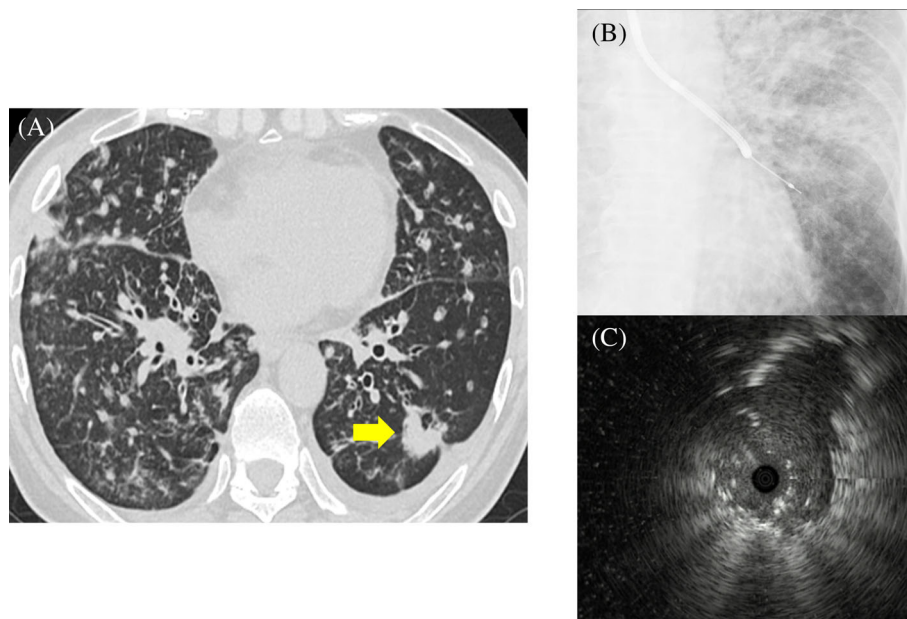


FIGURE 2 (A) We selected a 22-mm solid nodule (arrow) with a positive bronchus sign located in the left B9a. (B) The probe was consistently located within the lesion. (C) The radial endobronchial ultrasound probe was located within the lesion

for 3 months. Her medical history was unremarkable, but she had been smoking for 30 years (a half pack/day). Furthermore, her family had no history of the malignant tumours. Computed tomography revealed multiple nodules in her lungs, left pleural effusion, mild swelling in the mediastinal lymph nodes, and a nodule in the liver segment 8 (Figure 1).

The patient complained of worsening dyspnea because of carcinomatous lymphangiomatosis 4 days after her initial visit. Percutaneous oxygen saturation (SpO_2) worsened to 80% (room air), and a 3-L nasal cannula was required to maintain $>90\%$ SpO_2 . The partial pressure of oxygen and carbon dioxide in the arterial blood was 76.4 and 31.5 mmHg (nasal cannula, 3 L/min), respectively. The

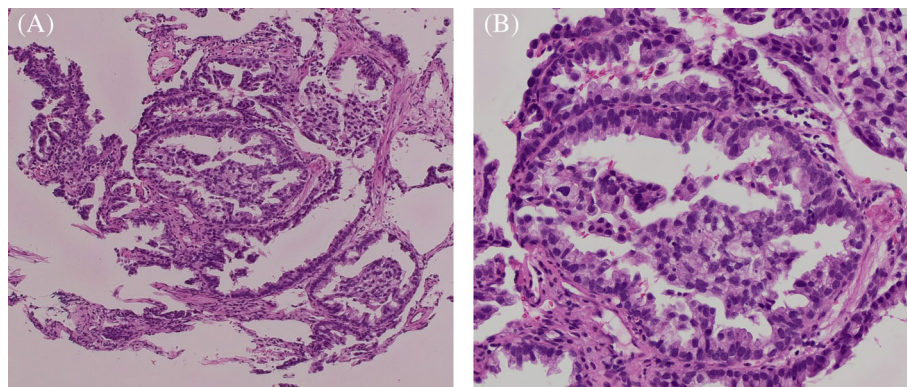


FIGURE 3 Histological findings obtained via transbronchial biopsy indicated adenocarcinoma (haematoxylin and eosin staining)

Eastern Cooperative Oncology Group Performance Status was determined to be III. Although fluorodeoxyglucose-positron emission tomography was scheduled, it could not be performed because of her worsening respiratory state. When considering biopsy sites other than those in the lung, the liver was selected initially; however, liver biopsy could not be performed because the patient could not hold her breath. Transthoracic needle biopsy is associated with higher pneumothorax, and surgical lung biopsy makes it harder for the patient to tolerate general anaesthesia; thus, bronchoscopy was performed. The patient did not want intubation to be the first diagnostic procedure. Her mediastinal lymph nodes were mildly small, and bronchoscopy under NPPV or HFNC was not possible because of the lack of such equipment. Finally, from the multiple pulmonary lesions, we selected a 22-mm solid nodule with a positive bronchus sign located in the left B9a area. Before the procedure, her SpO₂ was 94% (nasal cannula, 4 L/min) in the spine position. The upper airway was anaesthetised with 2% lidocaine spray, and an intravenous bolus of fentanyl was administered. The procedure was performed using a thin bronchoscope (BF-P290; Olympus Corporation, Tokyo, Japan) and radial endobronchial ultrasound (R-EBUS) through the transnasal route with an oxygen mask (10 L/min) to prevent hypoxaemia during the procedure. The R-EBUS was inserted into the left B9a. The probe was located within the lesion (Figure 2). Later, we performed six biopsies. During the bronchoscopy, her patient's SpO₂ was maintained at >90% with an oxygen mask at 10 L/min. The procedure was completed within 12 min without any complications.

The patient's pathological findings revealed lung adenocarcinoma 3 days after bronchoscopy (Figure 3). After 10 days since bronchoscopy, molecular genotyping demonstrated an activating EGFR mutation (exon 19 deletion). After receiving osimertinib (80 mg per day), the patient recovered from respiratory failure on day 21 and was discharged on day 40; her condition stabilized after 3 months of osimertinib use. However, although multiple pulmonary lesions gradually worsened after 6 months of osimertinib administration, the patient survived.

DISCUSSION

Selecting a biopsy site that is less invasive and associated with fewer complications is essential for patients with acute respiratory failure and suspected lung cancer. In the present case, pulmonary nodules were preferred over the mediastinal lymph nodes or hepatic nodule because of the patient's physical findings, her desire to not receive intubation management, and the lack of respiratory-assistive devices such as NPPV or HFNC in the bronchoscopy room.

Arranging a respiratory-assistive device in the bronchoscopy exam room is necessary to ensure patient safety during bronchoscopy. In our case, a strategy, other than mechanical ventilation, to prevent severe hypoxaemia during bronchoscopy was necessary. A previous report indicated that the use of HFNC and NPPV during bronchoscopy is useful for patients with acute respiratory failure to prevent hypoxaemia during bronchoscopy because these devices ensure a constant high flow at a fixed fraction of inspiratory oxygen.³ Moreover, NPPV during bronchoscopy provides constant expiratory positive airway pressure (EPAP), which prevents alveolar collapse, raises mean airway pressure, and decreases the work of breathing. On the other hand, HFNC during bronchoscopy does not always provide constant EPAP, but the washout of nasopharyngeal dead space is associated with improved gas exchange.³⁻⁵ A high-concentration oxygen mask was used in our case; it did not affect the positive airway pressure and nasopharyngeal dead space washout. However, in terms of providing sufficient oxygen supplement, the nasal route of bronchoscopy, rather than the oral route, may be beneficial to avoid hypoxaemia during bronchoscopy because of increasing oxygen supplementation through the oxygen mask rather than a nasal cannula.

The use of a thick bronchoscope through the nasal route is reportedly associated with an increasing failure rate of nasal insertion because of the possibility of failure to pass the thick bronchoscope and possible trauma to the nose.^{6,7} However, to the best of our knowledge, the use of a thin bronchoscope through the nasal route has been not reported to increase the failure rate of nasal insertion more than that of a thick bronchoscope. Furthermore, the amount of fentanyl required is slightly lower in patients assessed via the nasal route during

bronchoscopy than in those assessed via the oral route; it might be associated with reduce hypoxaemia during bronchoscopy.⁸ Thus, in cases where HFNC and NPPV are not available, our method of inserting a thin bronchoscope through the nasal cavity under a common device such as an oxygen mask may be clinically beneficial to reduce hypoxaemia during the procedure.

The prognosis of advanced lung cancer in patients with acute respiratory failure is poor.² The mortality rate in these patients is approximately 70%. In our case, the probability of survival for at least 6 months after the initial diagnosis would have been low if the patient did not receive molecular targeted therapy. Patients with acute respiratory failure with suspected advanced lung cancer may be more likely to receive appropriate treatment if less-invasive diagnostic methods and biopsy sites are used.

In conclusion, thin bronchoscopy through the nasal cavity under a high-concentration oxygen mask may be useful in making appropriate diagnosis, determining suitable therapy, and avoiding hypoxaemia in patients with acute respiratory failure. Since this method can be performed with common equipment, it may be widely applicable.

AUTHOR CONTRIBUTION

Yasushi Makino is the guarantor of the content of this manuscript. Takayasu Ito contributed to the draft of the manuscript. Shuko Mashimo, Tomoya Baba, Ryo Otsuki, Hirotohi Yasui, Yasutaka Fukui, Mitsuru Odate, Yoshifumi Arai, Shotaro Okachi, Keiko Wakahara, and Naozumi Hashimoto contributed to the editing of the manuscript.

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CONFLICT OF INTEREST

None declared.

DATA AVAILABILITY STATEMENT

Data available on request due to privacy/ethical restrictions

ETHICS STATEMENT

The authors declare that appropriate written informed consent from the patient's proxy was obtained for the publication of this manuscript and accompanying images.

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