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Case Report

Successful Surgical Resection following Bronchial Artery Embolization in a Case of Lung Cancer Complicated with Massive Hemoptysis

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Keywords
Lung cancer · Bronchial artery embolization · Hemoptysis

Abstract
Hemoptysis is sometimes observed in lung cancer patients and can be life-threatening. We present a case with severe hemoptysis that was resolved by bronchial artery embolization (BAE) followed by surgery. The presence of necrotic tissue in the majority of the resected tumor and only few cancer cells was presumed to be from loss of bronchial artery blood flow. Although BAE is not a standard therapy for lung cancer, it can be useful and may be considered by physicians as one of the treatment options prior to surgical resection in cases with hemoptysis.

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Introduction

Bronchial artery embolization (BAE) is a useful procedure in patients with hemoptysis secondary to both inflammatory lung disease, including bronchiectasis and pulmonary aspergillosis, and lung malignancy [1–3]. Some cases of lung cancer complicated with massive hemoptysis have been reported to effectively respond to BAE treatment [4]. Indeed, BAE is considered one of the palliative treatment options for hemoptysis in patients with lung cancer. Herein, we report a case of successful surgical resection following BAE for hemoptysis due to lung cancer.

Case Presentation

A 51-year-old Japanese man visited our hospital because of chronic cough and small amount of blood sputum for 2 months. He had no fever and weight loss. He had a 30-pack-year smoking history, but had no dust exposure. He had no underlying disease, and he had not taken any medicine. Physical examination showed body temperature of 36.7°C, blood pressure of 142/86 mm Hg, pulse rate of 80 beats per minute, and respiratory rate of 16 breaths per minute. Crackles were not audible on chest auscultation. Other physical examinations, including assessment of consciousness, abdomen, joints, and skin were normal.

Chest radiography showed a mass shadow on the right upper lung field (Fig. 1a). Chest computed tomography (CT) with contrast showed a 42-mm lobulated mass and consolidation in the right upper lobe (Fig. 1b, c). Laboratory findings were as follows: hemoglobin 13.9 g/dL, white blood cell count 9,620/μL, platelet count 37.2 × 10^4/μL, total protein 7.4 g/dL, albumin 4.3 g/dL, C-reactive protein 1.6 mg/dL, carcinoembryonic antigen 3.3 ng/mL, cytokeratin-19 fragment <1.0 ng/mL, squamous cell carcinoma antigen 0.9 ng/mL, and progastrin-releasing peptide 48.1 pg/mL. Coagulation profile, urinalysis, and other biochemical tests were within the normal range.

Initially, the plan was to perform bronchoscopy for pathological diagnosis. However, 1 week after the first visit, he developed massive hemoptysis amounting to 200 mL of fresh blood within 4 h. Based on the chest CT findings, the hemoptysis was assumed to have been caused by lung cancer. Evaluation for the bleeding source by bronchial arteriography revealed marked hypervascularity within the lung tumor (Fig. 2a). BAE was sequentially performed using trisacryl gelatin microspheres and resulted in the resolution of the hemoptysis.

One week after BAE, repeat chest CT showed reduction of the tumor size and the hypodense area in the tumor (Fig. 2b–e). There was no distant metastasis on fluorodeoxyglucose-positron emission tomography scan. Therefore, he underwent right upper lobectomy and radical lymph node dissection. Pathological findings revealed a wide area of necrosis with a small number of viable cancer cells in the tumor (Fig. 3a–c). These cells were morphologically diagnosed as invasive adenocarcinoma; no lymph node metastasis was observed in the surgical specimen.

Finally, he was diagnosed as having primary lung cancer, pathological stage IB (pT2aN0M0). Thereafter, he was administered adjuvant chemotherapy with oral tegafur-uracil according to the Japanese practice guidelines for lung cancer [5]. One year after the operation, he remained free from recurrence of lung cancer.

Discussion

Hemoptysis can be a life-threatening complication of primary lung cancer [6, 7] and sometimes occurs in association with treatment, such as radiation and intake of anti-angiogenesis agents [8]. In fact, 12% of lung cancer patients have been reported to die from pulmonary hemorrhage, as diagnosed by autopsy [9]. Hemoptysis in lung cancer is considered to be due to abnormal tumor angiogenesis, which results in fragile and irregular tumor blood vessels [10]. The most common feeding vessels in the lungs are supplied from the bronchial or costal arteries, with numerous anatomical variants [10]. Severe hemoptysis is mainly related to a bronchial artery (82%), and major pulmonary artery involvement is rare (6.4%) [11]. Based on these characteristics, BAE has become a well-established management for life-threatening hemoptysis, including that due to lung cancer [2, 6].

In a study by Razazi et al. [11] on 134 consecutive patients with primary lung cancer that was associated with severe hemoptysis of more than 100 mL, squamous cell carcinoma was the most frequent histology in 48%, followed by adenocarcinoma in 23%, small cell carcinoma in 7%, and others, including large cell carcinoma and pleomorphic carcinoma, in 22%. Although central location and tumor cavitation were reported to be risk factors for severe hemoptysis, the latter was observed in only 20% of lung cancer cases with hemoptysis [12]. Therefore, the risk of hemoptysis should be considered in all patients with lung cancer, just as in our case.

In the present case, surgical resection after BAE allowed detailed pathological examination of the resected specimen. Because BAE is often performed in advanced-stage lung cancer case, reports on the precise pathological findings after BAE have not been available [10]. The pathological findings in this case showed that almost the entire tumor contained necrotic tissue and that only approximately 10% of the tumor contained cancer cells. This suggested that most of the tumor tissues were replaced by necrotic tissue after embolization of the bronchial artery. Consequently, surgery could be safely performed and achieved complete resection.

Fatal hemoptysis has been reported in 2% of cases that have received stereotactic radiation therapy for lung cancer [8]. We consider that BAE may be one of the treatment options before radiation therapy in lung cancer patients who have a high risk of hemoptysis. In particular, the presence of direct invasion to the bronchus and hemoptysis could be indications for BAE prior to radiation therapy.

In conclusion, BAE can be considered by physicians as one of the treatment options prior to surgical resection in cases of lung cancer with hemoptysis.

Statement of Ethics

The authors have no ethical conflicts to disclose.

Disclosure Statement

All authors declare that there is no conflict of interest regarding the publication of this paper.

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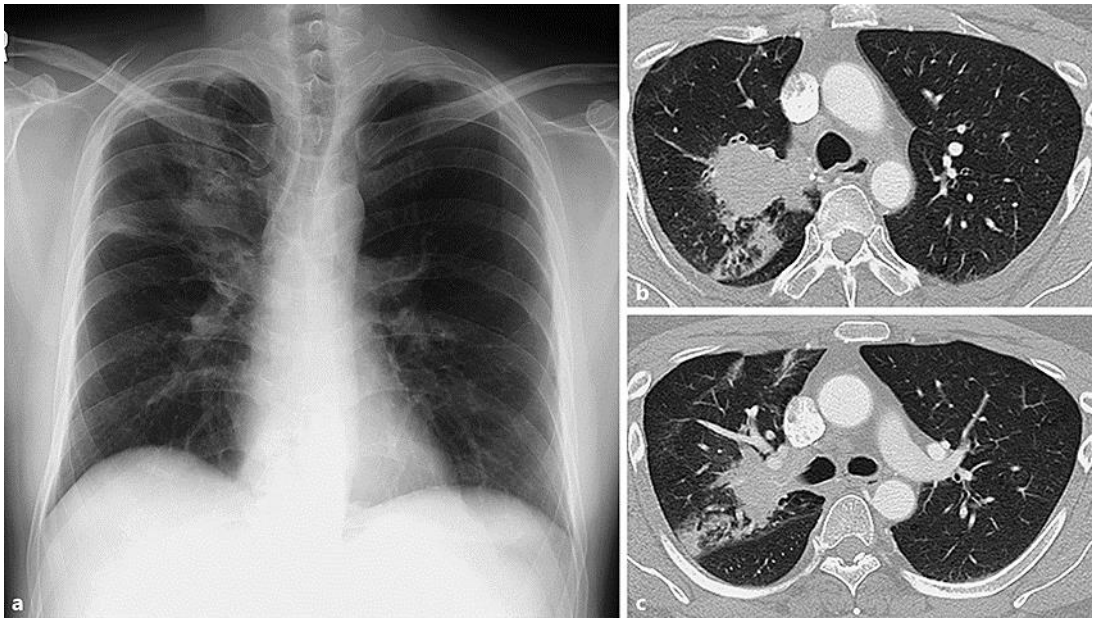

Fig. 1. Findings on chest radiography and CT. **a** Chest radiography shows a mass shadow in the right upper lung field. **b**, **c** Chest CT shows a 42-mm lobulated mass with ground-glass opacity in the right upper lobe. CT, computed tomography.

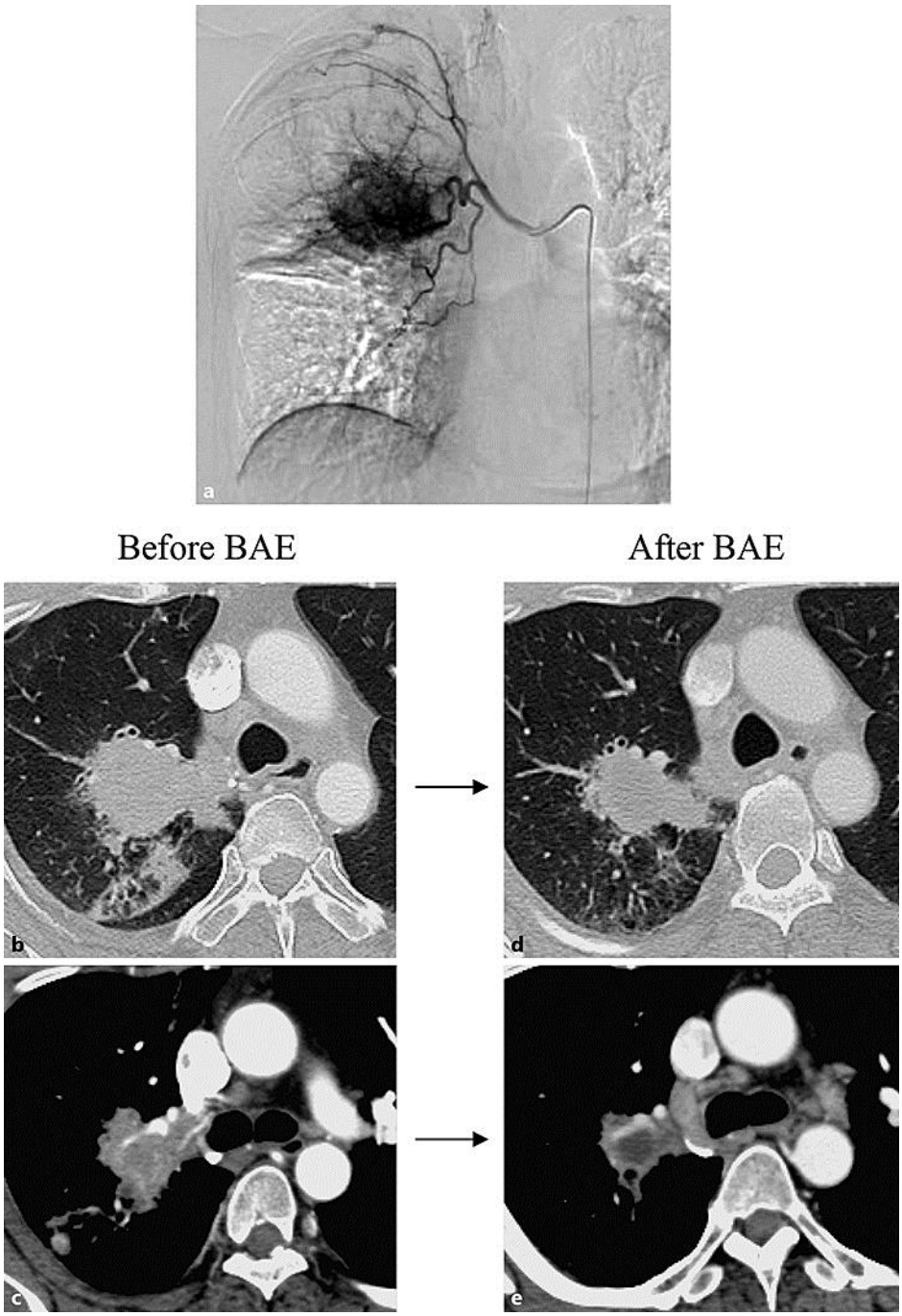

Fig. 2. Findings on bronchial arteriography and chest CT before and after BAE. **a** Bronchial arteriography with microcatheter shows marked hypervascularity within the lung tumor. Chest CT before (**b**, **c**) and after (**d**, **e**) BAE shows reduction of the tumor size and the hypodense area in the tumor. CT, computed tomography; BAE, bronchial artery embolization.

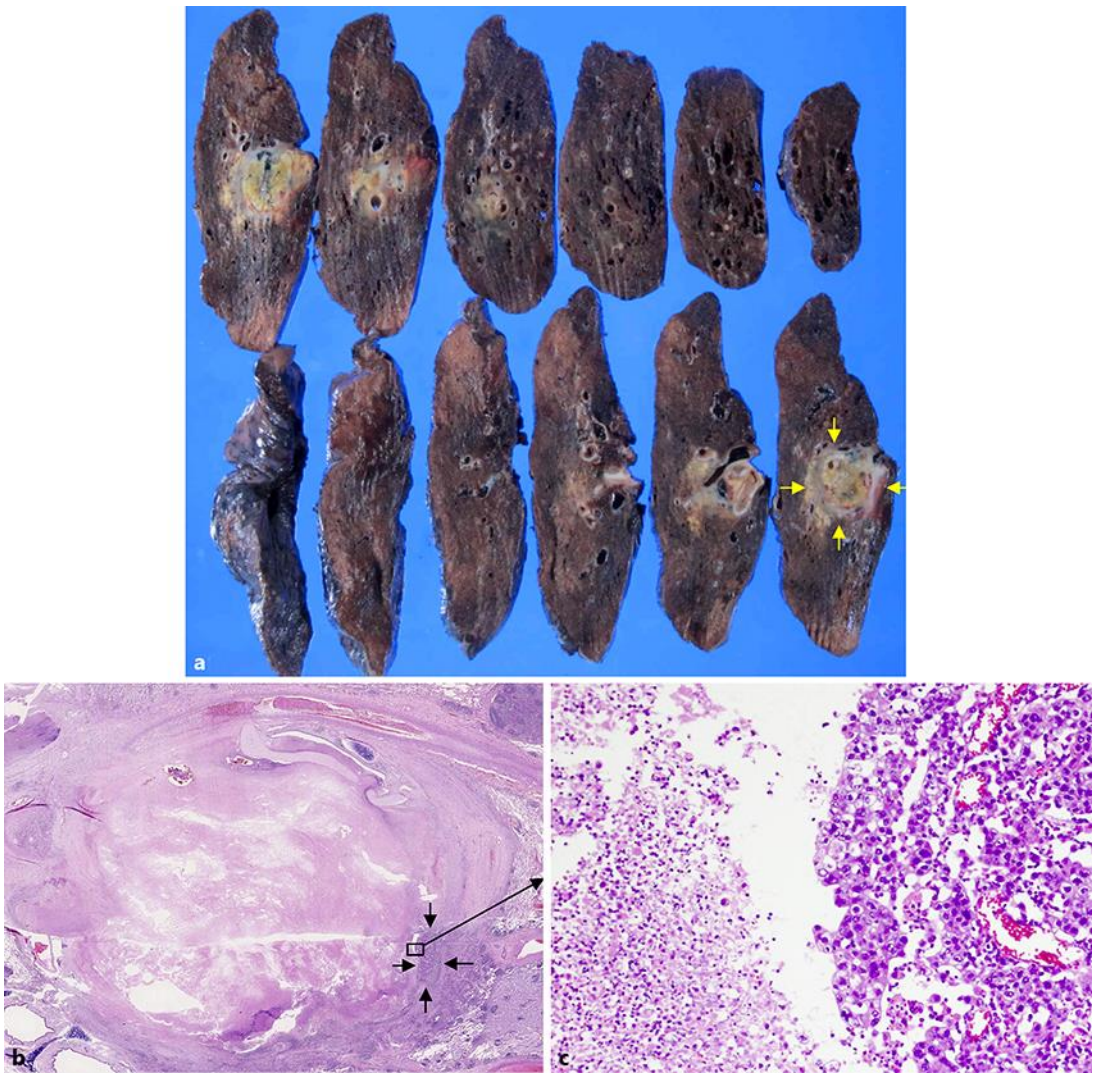

Fig. 3. Pathologic findings of the right upper lobectomy specimen. **a** Grossly, cut sections of the lung show the tumor including a wide area of necrosis (arrows). **b** Microscopic examination of the entire tumor shows that only a small area is occupied by cancer cells (arrows). Hematoxylin and eosin stain, loupe view. **c** High magnification view shows the boundary between cancer cells (right) and necrotic tissues (left). Hematoxylin and eosin stain, ×400.