Bronchiolitis Obliterans Organizing Pneumonia after Radiofrequency Ablation of Lung Cancer: Report of Three Cases

Takao Hiraki, MD, Hideo Gobara, MD, Katsuya Kato, MD, Shinichi Toyooka, MD, Hidefumi Mimura, MD, and Susumu Kanazawa, MD

ABSTRACT

The present report describes three cases of a bronchiolitis obliterans organizing pneumonia (BOOP)–like reactive pneumonitis following radiofrequency (RF) ablation for lung cancer. The incidence of BOOP-like reactive pneumonitis after RF ablation at the authors' institution was estimated to be approximately 0.4% (three of 840 sessions). The patients presented with nonspecific symptoms. Computed tomography images showed consolidation or ground-glass opacity in a peripheral-dominant distribution and/or patchy air-space opacities. The disease was nonresponsive to antibiotic therapy but responded favorably to pulse therapy of steroids. BOOP-like reactive pneumonitis should be recognized as a complication following lung RF ablation.

ABBREVIATIONS

BOOP = bronchiolitis obliterans organizing pneumonia, KL-6 = Krebs von den Lungen–6, RF = radiofrequency

Percutaneous radiofrequency (RF) ablation has become popular as a therapy for primary and metastatic lung cancer. An international survey (1) has reported that the mortality rate associated with RF ablation is only 0.4% (two of 493). However, RF ablation performed in cases of lung cancer induces various complications, the most frequent being pneumothorax (2). Here we report three cases of bronchiolitis obliterans organizing pneumonia (BOOP)–like reactive pneumonitis occurring after RF ablation for lung cancer.

CASE REPORTS

We obtained approval from the institutional review board to perform computed tomographic (CT) fluoroscopy–guided RF ablation for lung cancer, and to report the relevant data regarding these procedures. Informed consent was obtained from all patients.

Case 1

An 88-year-old man with chronic obstructive disease caused by a smoking history underwent stereotactic radiation therapy for stage IIB primary lung cancer in the right lower lobe. Six months after the therapy, the cancer showed local recurrence in the pretreated area, measuring 31 mm in diameter. RF ablation was performed for the recurrence at four different sites for a total of 48 min (12 min at each site) by using a single internally cooled electrode (Cool-tip; Covidien, Mansfield, Massachusetts) with a 3-cm noninsulated tip. The procedure was terminated uneventfully, and the patient was discharged 1 week after RF ablation.

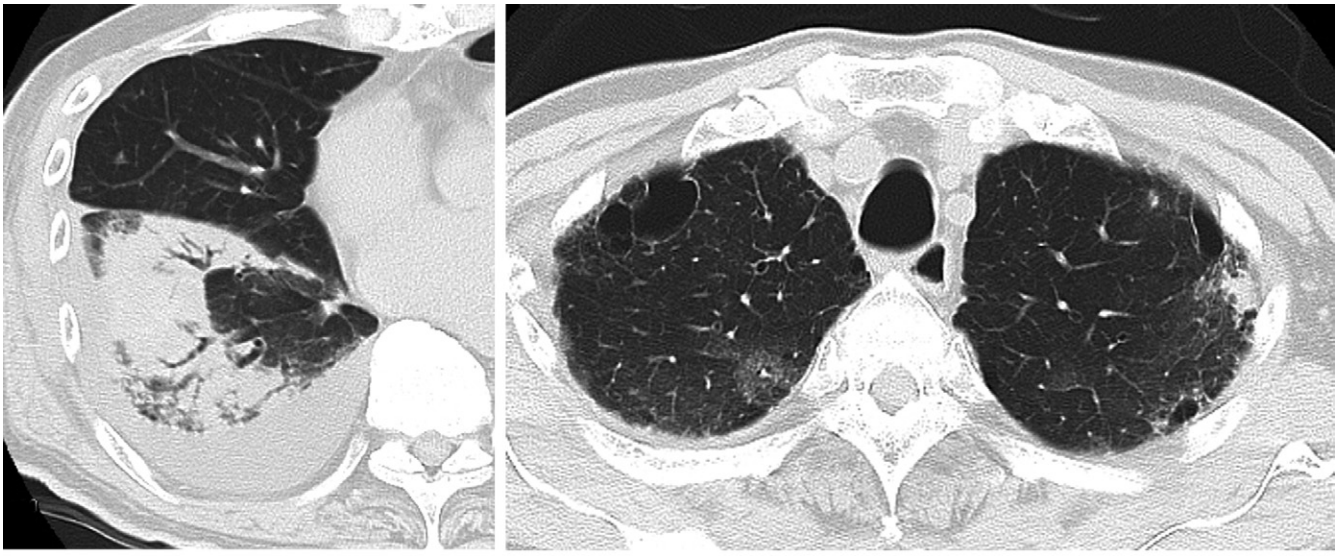
The patient was readmitted to the hospital 1 month after RF ablation with fever (> 38°C), cough, and sputum. A chest radiograph showed large infiltration in the right lower lung, which was diagnosed as acute pneumonia. The patient was therefore treated with intravenous antibiotic therapy for 5 days, but the symptoms did not improve. CT images 5 days after readmission revealed consolidation, showing a peripheral-dominant distribution in the right lower lobe (**Fig 1a**). In addition, patchy consolidations or ground-glass opacities were demonstrated predominantly in the subpleural area of the bilateral upper lobes (**Fig 1b**). These findings were considered to be compatible with

From the Departments of Radiology (T.H., H.G., K.K., S.K.) and Cancer and Thoracic Surgery (S.T.), Okayama University Medical School, 2-5-1 Shikata-cho, Kita-ku, Okayama 700-8558, Japan; and Department of Diagnostic Radiology 2 (H.M.), Kawasaki Hospital, Kawasaki Medical School Okayama, Japan. Received July 1, 2011; final revision received August 30, 2011; accepted September 9, 2011. **Address correspondence to** T.H.; E-mail: takaoh@tc4.so-net.ne.jp

None of the authors have identified a conflict of interest.

J Vasc Interv Radiol 2012; 23:126–130

DOI: 10.1016/j.jvir.2011.09.011



a. b.

Figure 1. Local recurrence after stereotactic radiation for primary lung cancer in an 88-year-old man. **(a)** CT image 1 month after RF ablation shows peripheral-dominant consolidation in the right lower lobe. Pleural effusion is also demonstrated. **(b)** CT image 1 month after RF ablation shows patchy consolidations or ground-glass opacities in the subpleural area of the bilateral upper lobes.

BOOP, and bronchoscopy was scheduled 2 days later. The chest radiograph showed considerable progression of lung infiltration. Blood counts revealed a leucocyte count of 8,250 cells/μL. Laboratory findings included C-reactive protein level of 16.04 mg/dL, Krebs von den Lungen–6 (KL-6) level of 360 U/mL (normal range, 0–499 U/mL), and surfactant protein D (SP-D) level of 189 ng/mL (normal range, 0.0–109.9 ng/mL). Increased serum surfactant protein D level is associated with various lung diseases, including interstitial pneumonia (3). The patient's oxygen saturation measured 94%–95% without supplemental oxygen. Clinical symptoms worsened, with development of severe malaise. The bronchoscopy was therefore canceled, and steroid therapy with intravenous prednisolone (500 mg) was immediately initiated. Thereafter, the symptoms improved considerably. Although the disease relapsed several times during the tapering of the steroid dosage, the lung infiltration had disappeared on a chest radiograph 3 months after RF ablation.

Case 2

A 53-year-old man with chronic obstructive disease caused by a smoking history underwent right upper and middle lobectomy for stage IB primary lung cancer. Two cancerous tumors recurred 2 years later and were treated with partial lung resection. Two years after the partial resection, two cancers had shown progression in the right lower lobe. One occurred at the surgical margin and measured 45 mm in diameter (**Fig 2a**); the other was pleura-based and measured 23 mm in diameter. A single RF ablation session was performed for both tumors. First, the lesion at the surgical margin was ablated at six different sites for a total of 72 min (12 min per site) with a single internally cooled electrode with a 3-cm noninsulated tip (Cool-tip; Covidien). Subsequently, the pleura-based cancer was ablated at two sites for a total of 15 min by using a multitined expandable electrode with an array diameter of 3 cm (LeVeen; Boston Scientific, Natick, Massachusetts). The procedure was terminated uneventfully.

After RF ablation, the patient had a high fever ($>$ 39°C), and a blood examination at 2 days showed a marked increase of C-reactive protein values (20.72 mg/dL). Chest CT images taken at 2 days demonstrated ground-glass opacities with superimposed reticular opacities and consolidations at the periphery of the right lower lobe (**Fig 2b**), away from the two ablation zones. These findings were considered to be compatible with BOOP. At that time, the patient's symptoms consisted of only slightly bloody sputum. Corticosteroid therapy with intravenous administration of prednisolone (125 mg) was initiated. An oral antibiotic agent was also prophylactically administered. Thereafter, the patient developed dyspnea and malaise. The ground-glass opacity enlarged on CT images 5 days after RF ablation. At that time, the serum KL-6 level was within normal limits (338 U/mL); serum procalcitonin level was also within normal range ($<$ 0.05 ng/mL). Bronchoscopy was scheduled to allow a pathologic diagnosis to be made. The following day, lung infiltration progressed markedly, with worsening of symptoms. Therefore, the bronchoscopy was canceled and intravenous prednisolone dosage was immediately increased to 1,000 mg/d. Immediately thereafter, the symptoms started to improve and were completely resolved after 3 days of administration of 1,000 mg/d prednisolone. Lung infiltration also responded favorably to steroid therapy, which was then tapered gradually. Lung infiltration disappeared on CT images 3 months after RF ablation.