

Tumor Seeding Following Lung Radiofrequency Ablation: A Case Report

Koichiro Yamakado,¹ Masao Akeboshi,¹ Atsuhiko Nakatsuka,¹ Haruyuki Takaki,¹ Motoshi Takao,² Hiroyasu Kobayashi,³ Osamu Taguchi,³ Kan Takeda¹

¹Department of Radiology, Mie University School of Medicine, Edobashi, Tsu, Mie 514-8507, Japan

²Department of Thoracic Surgery, Mie University School of Medicine, Edobashi, Tsu, Mie 514-8507, Japan

³Third Department of Internal Medicine, Mie University School of Medicine, Edobashi, Tsu, Mie 514-8507, Japan

Abstract

Lung radiofrequency (RF) ablation was performed for the treatment of a primary lung cancer measuring 2.5 cm in maximum diameter in a 78-year-old man. A contrast-enhanced computed tomography (CT) study performed 3 months after RF ablation showed incomplete ablation of the lung tumor and the appearance of a chest wall tumor 4.0 cm in maximum diameter that was considered to be the result of needle-tract seeding. RF ablation was performed for the treatment of both the lung and the chest wall tumors. Although tumor enhancement was eradicated in both of the treated tumors, follow-up CT studies revealed diffuse intra-pulmonary metastases in both lungs 2 months after the second RF session. He is currently receiving systemic chemotherapy.

Key words: Complication—Radiofrequencyablation—Lung neoplasm—Tumor seeding

Tumor seeding is one of the main complications of radiofrequency (RF) ablation of hepatic neoplasms [1]. The frequency of tumor seeding following liver RF ablation has been reported to be 0.2–12.5% [2–4].

Recently, RF ablation has been applied to the treatment of lung neoplasms [5–7]. Short-term results have shown that percutaneous pulmonary RF ablation is a safe, minimally invasive tool for local pulmonary tumor control with negligible mortality, reduced morbidity, a short hospital stay, and an improved quality of life [6].

To our knowledge, there have been no reports describing tumor dissemination following lung RF ablation. We treated a patient in whom tumor seeding was thought to have been caused by lung RF ablation. In this report, we describe our experience with this case.

Case Report

A total of 144 lung RF ablation procedures were performed in 67 patients at our institution from January 2002 to April 2004. Approval was obtained from our Institutional Review Board in all cases.

A 78-year-old man was referred to our department to undergo lung RF ablation for the treatment of an expanding lung tumor measuring 2.5 cm in maximum diameter in October 2003 (Fig. 1A). Initially, the tumor was suspected to be a metastatic lesion because the patient had undergone nephrectomy for renal cell carcinoma 7 years previously. The patient was advised that surgical intervention was required, but he and his family members refused.

After written informed consent was obtained from the patient and his family members, lung biopsy and RF ablation were performed percutaneously under computed tomographic (CT)–fluoroscopic guidance on the same day. Lung biopsy was performed using an 18G cutting needle biopsy device (ASAP DETACHABLE; Boston Scientific, Watertown, MA). The biopsy results were obtained 1 week later. The tumor was reported to be a poorly differentiated adenocarcinoma, confirming that the lung tumor was a primary lung cancer.

Lung RF ablation was performed immediately after biopsy. Following local anesthesia, a straight, 17G, cooled-tip RF electrode (Cool-tip Radiofrequency Ablation System; Radionics, Burlington, MA) was placed into the tumor on the first pass along the same route as the biopsy needle (Fig. 1B). After the electrode was placed at the center of the tumor under CT–fluoroscopic guidance, the RF generator was connected and RF energy was applied for 12 min [7]. The tissue temperature rose to 52°C immediately after RF ablation. Then, the RF electrode was withdrawn without cauterization of the electrode tract (i.e., without tract ablation).

Three months after lung RF ablation (January 2004), a contrast-enhanced CT study showed residual tumor enhancement in the ablated lung (Fig. 1C). A new enhancing tumor measuring 4.0 cm at maximum diameter was also observed in the posterior chest wall at a location corresponding to the puncture route of the RF electrode (Fig. 1C). A biopsy was performed for the chest wall tumor, which was identified as a poorly differentiated adenocarcinoma. Both the chest wall tumor and the residual lung tumor were treated by RF ablation. The RF electrode was inserted into the chest wall tumor under CT–fluoroscopic guidance and RF energy was applied at three different sites. Tract ablation was performed at each site when the RF electrode was withdrawn. Water-cooling was stopped and the temperature of the electrode was maintained at 80–90°C for 1 min in the ablated lesion. Then, the RF electrode was slowly withdrawn with the continued application of RF energy [3]. The residual lung tumor was ablated 1 week after the chest wall tumor was treated. The RF electrode was placed at the center of the tumor and RF energy was applied for 12 min. Tract ablation was performed in the same manner as for the chest wall tumor.

Although pleural effusion developed after the first lung RF ablation, no cancer cells were detected in the pleural fluid by aspiration (Fig. 1D).

After the second RF session, tumor enhancement was eliminated in both tumors (Fig. 1D). Follow-up CT studies, however, revealed diffuse intra-pulmonary metastases in both lungs 2 months after the second RF session

Correspondence to: Koichiro Yamakado; email: yama@clin.medi.mie-u.ac.jp

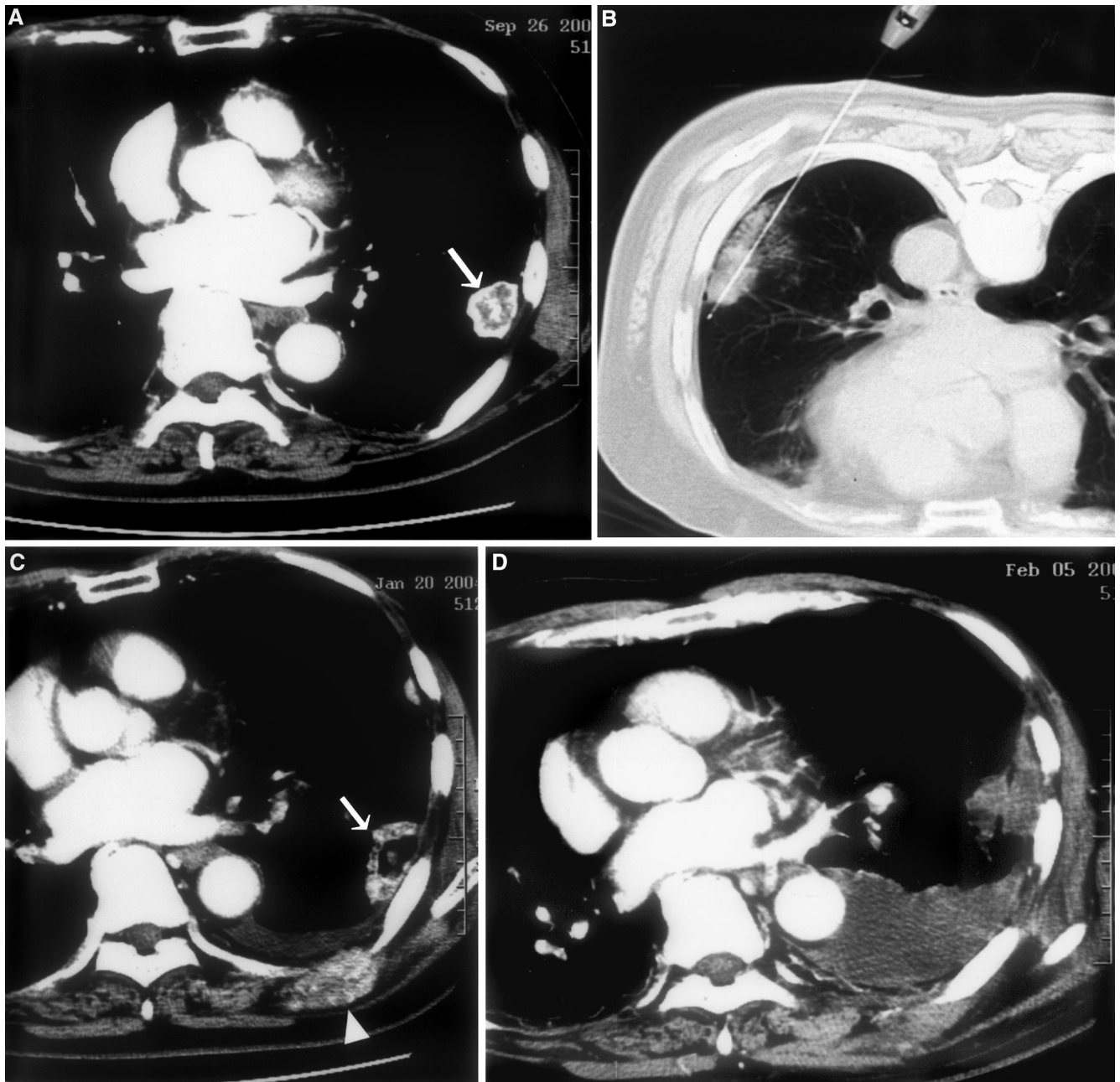


Fig. 1. **A.** An axial contrast-enhanced CT image shows a lung cancer (arrow) measuring 2.5 cm in maximum diameter in a 78-year-old man. **B.** The tumor was treated by RF ablation. The RF electrode was placed at the center of the tumor on the first pass under CT-fluoroscopic guidance. RF energy was applied for 12 min. **C.** An axial contrast-enhanced CT image acquired 3 months after lung RF

ablation shows incomplete ablation of the lung tumor (arrow) and the appearance of a chest wall tumor (arrowhead) thought to be due to tumor seeding. **D.** An axial contrast-enhanced CT image acquired 1 month after RF ablation was performed for the residual lung and chest wall tumors. Tumor enhancement was eradicated in both the tumors.

(March 2003). The patient is currently receiving systemic chemotherapy on an outpatient basis.

Discussion

Lung RF ablation is gaining increasing attention as a safe and useful therapeutic option for the treatment of unresectable lung neoplasms [5–7]. The most frequent complication is pneumotho-

rax, which occurs in 30–53.8% of RF sessions. However, chest drainage is required in less than 10% of interventions [6], and pleural effusion requiring aspiration occurs in less than 10% of cases [6]. With regard to severe complications, Steinke et al. reported 2 deaths after 463 procedures (0.4%), but the cause of death was not specified [6]. Herrera et al. reported fatal hemoptysis in 1 of 18 patients, and Vaughn et al. reported a case of massive hemorrhage during RF ablation [5, 8].

To our knowledge, there have been no reports of needle-tract tumor seeding following lung RF ablation. At our institution, 144 lung RF ablations have been performed in 65 patients with malignant lung neoplasms, and this is the first case (1.5% of patients, 0.7% of procedures) of tumor seeding along the needle tract.

Tumor seeding could occur when lung biopsy is performed immediately before RF ablation. However, tumor dissemination after lung biopsy is very rare, with a reported frequency as low as 0.02–0.18% [9, 10]. We, therefore, feel that the possibility of tumor dissemination due to biopsy is unlikely.

There are a number of possible reasons for tumor seeding after RF ablation. Viable cancer cells could adhere to the biopsy needle or RF electrode when it is retracted. Tumor cells could also enter the tract due to mild bleeding. In addition, tumor cells might be forced into the tract by an increase in intra-tumoral pressure during RF ablation. Risk factors for seeding in liver RF ablation have been reported to be pre-procedural biopsies, poor differentiation of the tumor, and failure to perform tract ablation [2, 3].

The risk factors that have been reported for liver RF ablation could also be applicable to lung RF ablation. In the present case, RF ablation was performed immediately after percutaneous lung biopsy and the RF electrode was withdrawn without tract ablation.

Lung biopsy, if required, should be performed on a different day before RF ablation. Poor differentiation of the tumor is a known risk factor for seeding after biopsy or RF ablation of liver neoplasms. In the present case, the tumor was resistant to RF ablation and disseminated after RF ablation. It is likely that the risk of tumor dissemination is increased when the therapeutic effectiveness is low. We now feel that tract ablation is mandatory to

prevent or at least minimize the risk of tumor seeding. Although the follow-up period in the present case is short, dissemination has not been observed following the second and third RF ablation procedures performed using tract ablation.

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