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CASE REPORT

Computed tomography-guided percutaneous microwave ablation of early stage non-small cell lung cancer in a pneumonectomy patient

Zhigang Wei, Jiao Wang, Xin Ye, Xia Yang & Guanghui Huang

Department of Oncology, Shandong Provincial Hospital affiliated to Shandong University, Jinan, Shandong Province, China

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Corresponding
Xin Ye, Department of Oncology, Shandong University affiliated Shandong Provincial Hospital, No. 423 Jingwuweiqi Road, Huaiyin Distinct of Jinan, Shandong Province, China.
Tel: +86 531 6877 3171
Fax: +86 531 6877 3172
Email: yexintaian2014@163.com

Zhigang Wei and Jiao Wang contributed equally to the manuscript.

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Abstract

A squamous cell lung cancer patient was treated with pneumonectomy. A recurrent lung cancer (adenocarcinoma) was found 45 months later and successfully biopsied and treated with microwave ablation. After 18 months of follow up, no evidence of tumor recurrence was observed.

Introduction

Radical surgery remains the standard treatment option for early stage non-small cell lung cancer (NSCLC) patients. However, around 2–5% of NSCLC patients who undergo pneumonectomy will develop metastatic spread to the other lung or develop a second primary tumor in the remaining lung.[1] There are few options for these patients. In patients selected strictly according to indications (i.e. highly selected), limited lung resection short of radical resection is possible.[2,3] Radiotherapy, especially stereotactic ablative radiotherapy, also could be applied.[4,5] However, most such patients do not have sufficient cardio-respiratory function to safely undergo surgery or radiotherapy. For patients unfit for or refusing surgery or radiotherapy, thermal ablation is an alternative option. Several studies have verified the efficacy and safety of radiofrequency ablation (RFA) in patients with a single lung remaining.[6–9] However, no reports of microwave ablation (MWA) in single lung patients has been observed. We reported treating such a patient with MWA and review relevant published reports.

Case report

In January 2009, a 56-year-old male underwent left pneumonectomy. Pathological examination of the resected specimen and images verified the diagnosis of squamous cell lung cancer in stage IIIA (T2N2M0). He received five cycles of adjuvant chemotherapy with paclitaxel and carboplatin. No adjuvant radiotherapy was conducted. At a follow-up 45 months later, a contract-enhanced computed tomography (CT) scan of the chest showed a 2.5 cm mass in the right lower lobe (Fig. 1a). Brain magnetic resonance imaging, abdominal CT, cervical and supraclavicular lymph node ultrasound, and a bone scan showed no evidence of lymph node involvement or distant metastases. A pulmonary function test showed a forced expiratory volume of only 1.47 L (49.2% of predicted). The patient refused irradiation and surgery. Therefore, a percutaneous CT guided biopsy and MWA (Fig. 1b) were conducted simultaneously. A 150 mm long semiautomatic biopsy gun with a diameter of 18G was used, together with an ablation antenna (YZB 1408–2003. No: SFDA [III] 20073251059; Nanjing Qiya Medical

Equipment Co., Jiangsu, China). The microwave emission frequency was 2450 ± 50 MHz, and the output level adjustable continuous wave ranged between 0~100 W. The microwave antenna had an effective length of 100–180 mm and an outside diameter of 14–20 G, with a long tapered pointed end; a water circulation cooling system was used to reduce the surface temperature of the antenna. The MWA antenna with an output of 60–80 W has an ablative zone of nearly 3.5 × 3 cm^2. Local anesthesia and pre-emptive analgesia were used. During the procedure, frozen section examinations verified the diagnosis of adenocarcinoma (Fig. 1c). The tumor was directly treated for eight minutes with an ablative energy of 70 W. No complications, such as pheumothorax, pleural effusion or bleeding, were observed. Forty-eight hours after ablation, the ablative site was surrounded by ground-glass opacity (Fig. 1d). Pathological examination of the biopsy specimen confirmed the diagnosis of adenocarcinoma, in stage IA (cT1bN0M0). Five days after the procedure, the patient was released from hospital. Radiological follow-up was performed at one, two, three, six, 12, and 18 months (Fig. 1f) after administration of the MWA. Complete ablation was achieved. At the last follow-up 18 months after this procedure, the patient was still alive without tumor recurrence.

Discussion

If metastasis or a second primary tumor develops in the remaining lung of patients who have previously undergone pneumonectomy, few treatment options are available. A few highly selected patients can tolerate and benefit from limited resection, particularly wedge resection and segmentectomy. Spaggiari *et al*. analyzed the survival of 13 patients with single lungs treated by limited resection: the median survival was 19 months and recurrence occurred in six patients (46.2%).[3] Terzi *et al*. reported a median survival of 21 months in 14 patients, with complications occurring in 21–31% of patients.[2] Studies using radiotherapy have also been reported. Haasbeek *et al*. reported that in 15 early stage patients treated with radiotherapy, with a median follow up of 16.5 months, no evidence of recurrence was observed; however, grade ≥3 toxicity was observed in 13.3% of patients.[4] Senthi *et al*. revealed that in 27 patients who received radiotherapy, the

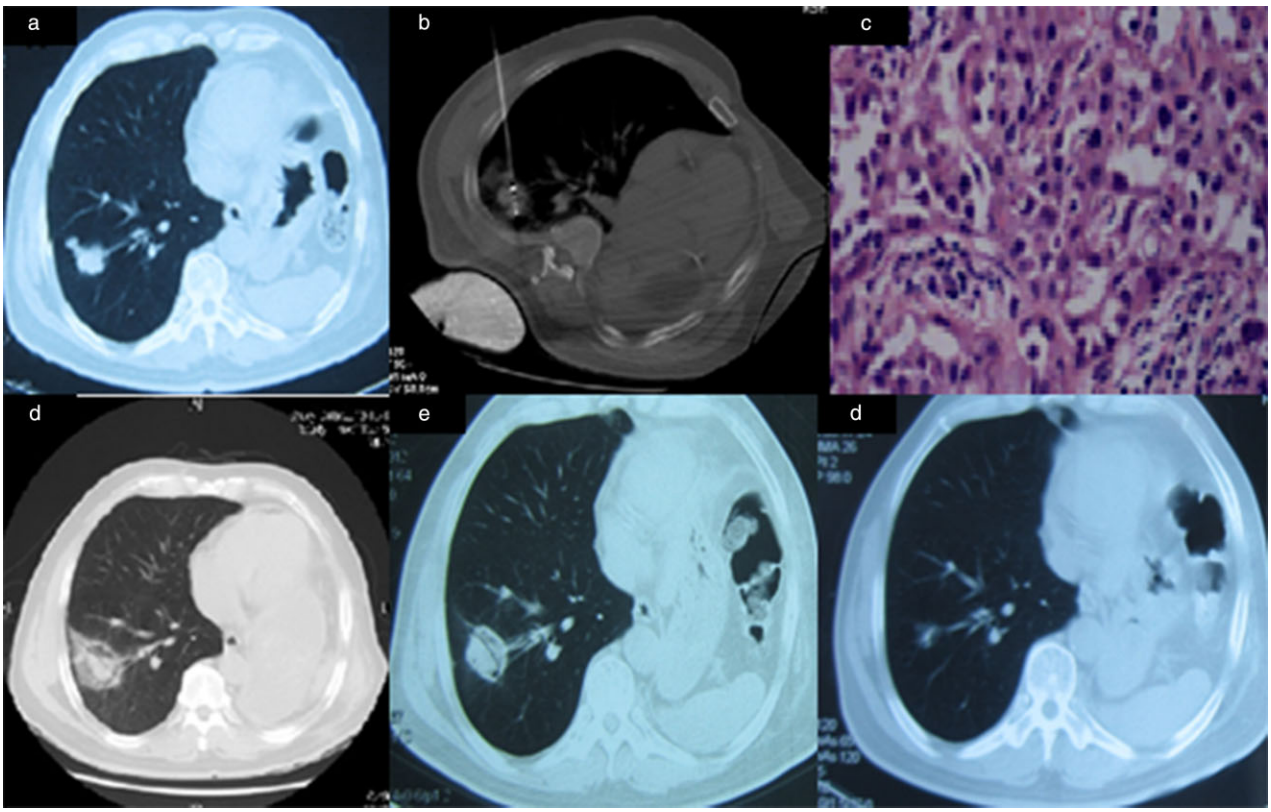

Figure 1 (**a**) A computed tomography scan shows a right lower lobe tumor in the lung window of a size of 2.5 × 2.0 cm. (**b**) An ablation antenna was placed in the tumor center. (**c**) Pathological diagnosis of adenocarcinoma (hematoxylin and eosin 200×). (**d**) Forty-eight hours after ablation, the ablative site was surrounded by ground glass opacity (GGO). (**e**) Three months after ablation, GGO decreased and scatter within the cavity was observed. (**f**) Eighteen months after ablation, only a scar in the ablative site was observed.

median overall survival was 39 months.[5] Only three patients (11.1%) experienced grade ≥ 3 toxicity.

Computed tomography-guided percutaneous thermal ablation, which is an effective means of achieving local control, is a possible alternative treatment that could be administered with curative intent. Several studies have explored the efficacy and safety of RFA for treating single lung patients.[6–9] Hess *et al*. retrospectively analysed data on 15 such patients treated with RFA, 11 with primary and four with metastatic lung cancers.[6] The mean age was 64 years and the diameters ranged from 0.4–3.7 cm. With a median follow up of 17.6 months, the two-year survival rate was 71.4% and one and two-year tumor-free survival was 58.7% and 19.6%, respectively. No procedural or post-procedural deaths occurred. Major complications, however, such as pneumothorax (37%) and hemorrhage (31%), did occur. The author concluded that RFA could be an effective and safe technique for treating single lung patients with cancer. Several other studies have supported this conclusion.[7–9]

RFA is the most widely used means of thermal ablation. The new means of thermal ablation of MWA has several dramatic advantages over RFA. MWA allows ablation of substantially larger tumors by using higher temperatures for a shorter time and its ablative effect is independent of the heat sink effect. Furthermore, MWA does not require impedance monitoring to avoid tissue impedance.[10]

Major complications of MWA, including pneumothorax, pleural effusion, and pneumonia, occur in 20.6% of cases.[11] Other complications include asymptomatic pheumothorax, asymptomatic pleural effusion, and hemoptysis. No complications were observed in our study.[12]

We, therefore, suggest that MWA may be feasible in pneumonectomy patients. However, our conclusion requires further verification.

Disclosure

No authors report any conflict of interest.

References

1 Deschamps C, Pairolero PC, Trastek VF, Payne WS. Multiple primary lung cancers. Results of surgical treatment. *J Thorac Cardiovasc Surg* 1990; **99**: 769–77.
2 Terzi A, Lonardoni A, Scanagatta P, Pergher S, Bonadiman C, Calabrò F. Lung resection for bronchogenic carcinoma after pneumonectomy: A safe and worthwhile procedure. *Eur J Cardiothorac Surg* 2004; **25**: 456–9.
3 Spaggiari L, Grunenwald D, Girard P *et al*. Cancer resection on the residual lung after pneumonectomy for bronchogenic carcinoma. *Ann Thorac Surg* 1996; **62**: 1598–602.
4 Haasbeek CJ, Lagerwaard FJ, de Jaeger K, Slotman BJ, Senan S. Outcomes of stereotactic radiotherapy for a new clinical stage I lung cancer arising postpneumonectomy. *Cancer* 2009; **115**: 587–94.
5 Senthi S, Haasbeek CJ, Lagerwaard FJ *et al*. Radiotherapy for a second primary lung cancer arising post-pneumonectomy: Planning considerations and clinical outcomes. *J Thorac Dis* 2013; **5**: 116–22.
6 Hess A, Palussière J, Goyers JF, Guth A, Aupérin A, de Baère T. Pulmonary radiofrequency ablation in patients with a single lung: Feasibility, efficacy, and tolerance. *Radiology* 2012; **258**: 635–42.
7 Ambrogi MC, Fanucchi O, Lencioni R, Cioni R, Mussi A. Pulmonary radiofrequency ablation in a single lung patient. *Thorax* 2006; **61**: 828–9.
8 Modesto A, Giron J, Massabeau C, Sans N, Berjaud J, Mazieres J. Radiofrequency ablation for non-small-cell lung cancer in a single-lung patient: Case report and review of the literature. *Lung Cancer* 2013; **80**: 341–3.
9 Sofocleous CT, May B, Petre EN *et al*. Pulmonary thermal ablation in patients with prior pneumonectomy. *AJR Am J Roentgenol* 2011; **196**: W606–12.
10 Sonntag PD, Hinshaw JL, Lubner MG, Brace CL, Lee FT Jr. Thermal ablation of lung tumors. *Surg Oncol Clin N Am* 2011; **20**: 369–87.
11 Zheng A, Wang X, Yang X *et al*. Major complications after lung microwave ablation: A single-center experience on 204 sessions. *Ann Thorac Surg* 2014; **98**: 243–8.
12 Carrafiello G, Mangini M, Fontana F *et al*. Microwave ablation of lung tumours: Single-centre preliminary experience. *Radiol Med* 2014; **119**: 75–82.

