Radiofrequency ablation of pulmonary lesions

M. Cariati1 · G. Giordano3 · M. Midulla1 · A.M. Calati2 · A. Sacrini1 · F. Raveglia2 · G.P. Cornalba4

1 U.O. Radiologia Diagnostica Interventistica, Azienda Ospedaliera San Paolo, Via di Rudini 8, I-20142 Milano, Italy
2 U.O. Chirurgia II, Azienda Ospedaliera San Paolo, Via di Rudini 8, I-20142 Milano, Italy
3 Scuola di Specializzazione in Radiodiagnostica, Università di Milano, Azienda Ospedaliera San Paolo, Milano, Italy
4 Cattedra di Radiologia, Università di Milano, Milano, Italy

Correspondence to: M. Cariati, Tel.: +39-02-81844652, Fax: +39-02-50323393, e-mail: maurizio.cariati@ao-sanpaolo.it

Received: 13 April 2006 / Accepted: 13 May 2006 / Published online: 19 March 2007

Abstract

**Purpose.** Radiofrequency ablation uses the thermal energy produced by a generator to create a coagulative necrosis. The method is well established for the treatment of a variety of primary and secondary cancers of the liver but is less well studied for the treatment of lung malignancies.

**Materials and methods.** From March 2005 to March 2006, 11 patients (seven men and four women) with single or multiple pulmonary nodules underwent radiofrequency ablation of 12 unresectable pulmonary tumours. Follow-up computed tomography (CT) was performed at 1, 3, 6, and 12 months after radiofrequency ablation. Lesions were evaluated for dimensions and contrast enhancement.

**Results.** Radiofrequency ablation was well tolerated by all patients. Postprocedural complications included four cases of pneumothorax treated with simple aspiration without tube placement and one case of small parenchymal haemorrhage. There were no major complications.

**Conclusions.** Radiofrequency ablation of primary or secondary pulmonary lesions is a safe and technically feasible option for the management of unresectable pulmonary malignancies.

**Key words** Pulmonary radiofrequency · Lung neoplasms · Radiofrequency ablation

Introduction

Lung cancer is the leading cause of cancer-related deaths in the United States. The American Cancer Society has estimated that the number of deaths from lung cancer in 2005 was around 90,490 for men and 73,020 for women. In the USA, 172,570 new cases of lung cancer are diagnosed each year, and about 60% of these patients will die within 1 year and about 75% within 2 years of diagnosis [1].
Surgical resection is the best treatment option for early lung cancer, with 5-year survival rates of approximately 80% for stage I cancers and of 40% for stage II cancers [2]. However, only 15% of patients with lung malignancies are eligible for surgery, owing either to widespread disease or to cardiopulmonary comorbidities that limit the indications for surgery [3, 4]. The lung is also the second most frequent site of metastasis. Local treatment may be useful in localised metastatic disease, with 25% 10-year survival rates and 90% disease-free 10-year survival rates being reported for metastasectomy in selected patients [5].

The last decade has seen the development of minimally invasive therapies using thermal energy, such as radiofrequency (RF), cryoablation, lasers and microwaves. RF ablation is a technique that relies on high-frequency alternating current to generate a localised electromagnetic field that heats the target tissue, causing necrosis. The tumour cells die with exposure to high temperatures for a number of reasons, in particular because of increased sensitivity to heat and decreased heat dissipation [6].

The advent of bipolar and multielectrode RF ablation probes with water-cooled tips has enabled the creation of larger areas of necrosis, thereby expanding the clinical applications of RF ablation. Although the clinical application of RF ablation to liver neoplasms is increasingly gaining increased use in the technique in lung malignancies is not well established [7, 8]. The safety of percutaneous RF ablation in lung malignancies has been assessed by a number of authors, including Goldberg who reported that the necrosis generated by RF can be controlled, predicted and easily monitored [9].

Materials and methods

Between March 2005 and March 2006, 11 patients (seven men and four women) aged 59–82 (mean 70.6) years underwent computed tomography (CT)-guided RF ablation of pulmonary nodules at the Division of Diagnostic and Interventional Radiology of the San Paolo Hospital in Milan.

All patients had primary or secondary pulmonary malignancies and were not eligible for surgery due to poor cardiorespiratory status or the presence of other extrapulmonary localisations. Ten patients had a single pulmonary nodule with a diameter less than 3 cm, whereas one had two nodules, both smaller than 3 cm (Table 1).

All lesions had previously undergone needle biopsy and received a histological diagnosis. Ineligibility for surgery was decided by consensus by an interdisciplinary team composed of a radiologist, a surgeon and an anaesthetist in all cases.

Before RF ablation, patients underwent an accurate clinical and anaesthesiological assessment and provided their informed consent.

Continuous cardiac, blood pressure and oxygen satura-