CLINICAL STUDY

Percutaneous Thermal Ablation for Small-Cell Lung Cancer: Initial Experience with Ten Tumors in Nine Patients

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ABSTRACT

Purpose: To evaluate outcomes in a small cohort of patients with local or disseminated small-cell lung cancer (SCLC) who received percutaneous thermal ablation therapy.

Materials and Methods: Ten biopsy-proven SCLC tumors in 9 consecutive patients (5 men, 4 women; average age, 73.8 y ± 12.4) were retrospectively evaluated. Average tumor sizes were 1.8 cm ± 0.5 and 2.6 cm ± 1.2 among patients with local and disseminated disease, respectively. Microwave and radiofrequency ablation were each used for 5 tumors. None of the patients with local SCLC received adjuvant therapy following thermal ablation. Median follow-up duration was 16 months (range, 2–48 mo). Median and 1-year overall survival (OS) were compared for patients in the local and disseminated disease groups.

Results: Median and 1-year OS were better among patients treated for local SCLC compared with disseminated disease (47.0 vs 5.5 mo and 3 [100%] vs 2 [40%], respectively). Pneumothorax occurred in 5 patients (55.6%), and 3 patients received successful outpatient thoracostomy tube placement. No patients were hospitalized, and there were no major complications.

Conclusions: This preliminary analysis suggests favorable outcomes in selected patients with local SCLC who undergo percutaneous thermal ablation without adjuvant therapy.

ABBREVIATIONS

FDG = [^{18}F]fluorodeoxyglucose, MW = microwave, NSCLC = non–small-cell lung cancer, OS = overall survival, PET = positron emission tomography, RF = radiofrequency, SCLC = small-cell lung cancer

Small-cell lung cancer (SCLC) is a high-grade neuroendocrine tumor that constitutes approximately 15% of all primary pulmonary malignancies (1). It is clinically distinct from other lung tumors, with a propensity for early metastatic disease and local tumor progression despite aggressive chemoradiation therapy, to which it often rapidly develops resistance. Approximately 70% of patients are diagnosed with extensive-stage disease at presentation (2), defined as spread beyond the ipsilateral hemithorax and regional lymph nodes. Without treatment, median overall survival (OS) ranges from 2 to 4 months, and 5-year survival rates are approximately 5%–10% for all patients, even with modern therapies (3). The primary prognostic factors are limited- versus extensive-stage disease, patient performance status, and—when applicable—time to relapse following initial therapy (4).

Many chemotherapeutic agents have activity against SCLC, and the current treatment paradigm for limited-stage disease includes simultaneous administration of at least two agents—such as etoposide and cisplatin—alongside thoracic radiation therapy and prophylactic cranial irradiation. Patients with extensive-stage disease at presentation typically receive only systemic chemotherapy (5), but there may be a role for radiation therapy in those whose disease responds to chemotherapy (6). Because of the aggressive nature of the disease, there is currently no role for surgical intervention in an SCLC treatment protocol, but it can be pursued in carefully selected patients with localized disease (7).

In non–small-cell lung cancer (NSCLC), multiple prospective and retrospective nonrandomized trials have demonstrated durable short- and intermediate-term treatment outcomes following percutaneous thermal ablation of primary and oligometastatic pulmonary

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malignancies (8–12), with reported disease-specific 2-year survival rates as high as 92% for primary NSCLC. However, to date, published data are unavailable regarding the utility of thermal ablation techniques among patients with SCLC. Accordingly, the purpose of the present study was to evaluate outcomes following percutaneous thermal ablation in a small cohort of patients with SCLC and identify opportunities for further investigation within this realm.

MATERIALS AND METHODS

This Health Insurance Portability and Accountability Act–compliant study was performed with a waiver of informed patient consent following institutional review board approval. A retrospective review of electronic medical records was performed to identify nine consecutive patients (five men, four women; average age, 73.8 y ± 12.4) with 10 biopsy-proven SCLC tumors who underwent percutaneous thermal lung ablation with curative intent between the years of 2004 and 2016. A total of three patients with local SCLC and seven patients with disseminated SCLC were analyzed. Microwave (MW) and radiofrequency (RF) ablation were each used in five treatments. The average tumor size among patients with local disease at the time of treatment was 1.8 cm ± 0.5; the average tumor size was 2.6 cm ± 1.2 among patients with disseminated disease. The median follow-up duration was 16 months (range, 2–48 mo). Complete patient and ablation data are summarized in Table 1.

Primary and recurrent small-cell cancers were included for analysis. Patients treated for extrapulmonary metastatic SCLC tumors were not included. Patient demographic data and medical history were collected, including information pertaining to pre- and postablation diagnostic testing/imaging, tumor staging, and receipt of any adjuvant and/or neoadjuvant medical, radiation, and/or surgical treatments. Tumor staging was performed by using the tumor/node/metastasis system as described in the American Joint Committee on Cancer Staging Manual, 7th Edition (13).

Patients were selected for ablation therapy following discussion at a multidisciplinary thoracic oncology tumor board with input from medical, surgical, and radiation oncologists. The decision to pursue percutaneous treatment was typically made after the patient was deemed a poor surgical candidate or following chemotherapy and/or radiation therapy for extensive-stage disease with a focus of residual or recurrent disease that was amenable to local percutaneous therapy.

Ablations were performed in a single session under computed tomographic (CT) fluoroscopy guidance. Patients received conscious sedation with intravenous midazolam and fentanyl; general anesthesia was not used in any case. Procedures were performed by one of two operators (D.E.D., T.T.H.) with 18 and 7 years of experience in lung ablation, respectively. Ablation treatments were provided on an outpatient basis; all patients were discharged home the same day in the absence of complications requiring hospital admission. Any complications that occurred within 30 days of the procedure were noted, including any necessary intervention.

Depending on operator preference, ablations were conducted with RF or MW energies. The specific MW generators used included the Evident system (45 W, 915 MHz; Covidien, Dublin, Ireland) with 14.5-gauge applicators with 2.0-cm or 3.7-cm active tips, the AveCure system (32 W, 902–928 MHz; MedWaves, San Diego, California) with 14- or 16-gauge applicators

Table 1. Patient and Ablation Data

Pt. No./ Age (y)/ Sex	Tumor Location	Tumor Size (cm)	Ablation Modality	Stage		Primary or Recurrent at Ablation	Patient Comorbidities	Previous Therapies
				At Initial Diagnosis	At Time of Ablation			
1/83/M	RUL	2.3	RF	IA	IA	Primary	Ulcerative colitis, ankylosing spondylitis	–
2/81/F	RUL	1.3	RF	IIIA*	IIIA*	Primary	COPD, CAD, CKD	–
3/78/M	RUL	1.8	MW	IA	IA	Primary	COPD, hypertension	–
4/70/F†	LLL	2.0	MW	IV*	IV*	Primary	COPD, pulmonary fibrosis	–
5/50/M	RUL	4.8	MW	IA	IIA	Recurrent	–	Chemoradiation
6/86/F	LUL	2.1	MW	IIIA	IA	Recurrent	COPD, CAD, hypertension	Chemoradiation
7/72/F	RUL	1.2	MW	IIIA	IA	Recurrent	COPD	Chemotherapy
8/59/M	RUL	2.5	RF	IV	IV*	Recurrent	COPD	Chemoradiation
	LLL	2.1						
9/85/M	LUL	3.3	RF	IV	IB	Recurrent	COPD, DM	Chemoradiation

CAD = coronary artery disease; CKD = chronic kidney disease; COPD = chronic obstructive pulmonary disease; DM = diabetes mellitus; LUL = left upper lobe; MW = microwave; RF = radiofrequency; RUL = right upper lobe.

*See text for further description of tumor staging in these patients.

†This patient was excluded from quantitative survival analysis.