CLINICAL STUDY

Intermediate Outcomes and Predictors of Efficacy in the Radiofrequency Ablation of 100 Pathologically Proven Renal Cell Carcinomas

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ABSTRACT

Purpose: To determine oncologic outcomes and predictors of primary efficacy, including RENAL nephrometry scores (radius, exophytic/endophytic properties, nearness of tumor to collecting system or sinus, anterior/posterior, location relative to polar lines), after percutaneous radiofrequency (RF) ablation of proven renal cell carcinoma (RCC).

Materials and Methods: Patients who underwent percutaneous computed tomography– and ultrasound-guided RF ablation for histologically proven RCC from 2004 to 2011 were evaluated. Clinical data, pathologic findings, technical details, and outcomes were reviewed. Univariate and multivariate logistic regression analysis was performed to determine predictors of primary technique effectiveness and complications. Local tumor progression–free, metastasis-free, and overall survival were calculated. One hundred RCC lesions underwent 115 RF ablation sessions in 84 patients. Median follow-up was 24 months (mean, 27 mo; range, 1–106 mo).

Results: Efficacy of RF ablation was defined per International Working Group of Image-Guided Tumor Ablation criteria. Total, primary, and secondary technique effectiveness rates were 95% (95 of 100), 86% (86 of 100), and 9% (nine of 100), respectively. Primary efficacy was associated with size ($P < .001$), proximity to collecting system ($P = .001$), RENAL nephrometry score ($P < .001$), and number of ablation zones ($P < .001$). Complications occurred in 13% of patients, without procedure-related deaths. The median 2.1-year local progression–free, metastasis-free, disease-specific, and overall survival rates were 86%, 98.7%, 100%, and 97.6%, respectively.

Conclusions: Percutaneous image-guided RF ablation for RCC provides excellent intermediate oncologic control. Location, size, proximity to the collecting system, low RENAL nephrometry score, and number of ablation zones predict primary efficacy.

ABBREVIATIONS

IWG-IGT = International Working Group of Image-Guided Tumor Ablation, RENAL = Radius, Exophytic/Endophytic properties, Nearness of tumor to collecting system or sinus, Anterior/posterior, Location relative to polar lines, RCC = renal cell carcinoma, RF = radiofrequency

The incidence of renal cell carcinoma (RCC) is increasing 2%–4% per year, with an estimated 65,000 new cases diagnosed in 2013 (1,2). The management of RCC has evolved from radical nephrectomy to partial nephrectomy with minimally invasive surgery (3,4). Ablative techniques such as radiofrequency (RF) ablation and cryoablation are becoming more commonplace in the treatment of patients with RCC (5–11).

A number of single-institution cohort studies on ablative therapy (12,13) have reported short- and long-term oncologic outcomes comparable to those of surgery. The majority of these studies are limited by small study size, inadequately reported pathologic findings in all cases, heterogeneity in treatment approaches (ie, percutaneous combined with laparoscopic approaches), and heterogeneity in ablation treatment (ie, combined RF ablation and cryoablation). Because as many as 20% of renal masses less than 4 cm are benign, treating these benign lesions improves the overall treatment efficacy

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of surgical and ablative techniques, and the true oncologic efficacy may be inflated (14). Nonetheless, thermal ablation has become an accepted treatment alternative to surgery by the American Urological Association for patients with major comorbidities or for those with familial syndromes and/or genetic predisposition for multifocal, bilateral RCC (15).

It is important to understand predictors of success to help guide patient management given the increased use of percutaneous RF ablation in the management of RCC. Known predictors of success in percutaneous RF ablation are limited to lesion size and location, with exophytic and lesions smaller than 4 cm having better primary efficacy (9,16–20). There is limited understanding of other predictors for successful treatment.

Kutikov and Uzzo (21) recently developed the RENAL nephrometry score to better understand and standardize the description of renal masses. This assesses the radius (ie, tumor size as maximal diameter), exophytic/endophytic properties of the tumor, nearness of tumor deepest portion to the collecting system or sinus, anterior/posterior descriptor, and the location relative to the polar line. There are two studies that have evaluated RENAL nephrometry score and its ability to predict outcomes in ablation, with one study demonstrating its ability to predict complications (20) and the other study showing no correlation (22). The purpose of the present study is to review the efficacy of percutaneous ultrasonography (US)- and computed tomography (CT)–guided RF ablation for histologically proven RCC, report intermediate-term oncologic outcomes, and analyze the predictive value of RENAL nephrometry score on RF ablations.

MATERIALS AND METHODS

This was an institutional review board–approved, Health Insurance Portability and Accountability Act of 1996–compliant, retrospective study. The study cohort included consecutive patients with histologically proven RCC treated with percutaneous RF ablation at a large tertiary care institution between February 2004 and December 2011. A total of 149 patients underwent thermal ablation for renal masses that had imaging findings concerning for RCC. Patients were excluded if pathologic analysis demonstrated non-RCC histology, if ablation techniques other than RF ablation were used, or if there was inadequate follow-up. Of excluded patients 40% (26 of 65) had non-RCC pathologic findings, 23.1% (15 of 65) had ablation techniques other than RF ablation, and 36.9% (24 of 65) did not have follow-up. One hundred fifteen percutaneous CT-/US-guided RF ablations for 100 histologically proven RCCs in 84 patients were performed. **Tables 1 and 2** show clinical and pathologic data. The median lesion diameter was 2.3 cm (mean, 2.6 cm; range, 0.7–6 cm). Eighty-five percent of lesions were diagnosed by biopsy, 79% of which were performed at time of RF ablation. The remainder were proven by surgical resection of another lesion before ablation. The most common histologic subtype was

Table 1. Patient Demographics

Characteristic	Value
Mean age (y)	
Mean	70.3
Median	72
Range	34–89
Sex	
Male	51 (61)
Female	33 (39)
ASA score ()	
Mean	2.7
Median	3
Range	2–3
Tumors per patient	
1	74 (88.1)
2	7 (8.3)
3	1 (1.2)
4	1 (1.2)

Values in parentheses are percentages.
ASA = American Society of Anesthesiologists.

Table 2. Tumor Demographics

Finding	Value
RCC type	
Clear-cell	55
Oncocytic	19
Papillary	13
Not otherwise specified	10
Chromophobe	3
Source of tissue diagnosis	
Previous surgery	15 (15)
Biopsy	79 (79)
Outside biopsy	6 (6)
Size (cm)	
Mean (median)	2.6 (2.3)
Range	0.7–6.0
Laterality	
Right	54 (54)
Left	45 (45)
Transplant	1 (1)
Polarity	
Upper pole	24 (24)
Interpole	41 (41)
Lower pole	35 (35)
Location	
Exophytic	58 (58)
Central	16 (16)
Mixed	26 (26)

Values in parentheses are percentages.
RCC = renal cell carcinoma.