Long-Term Outcomes of Renal Tumor Radio Frequency Ablation Stratified by Tumor Diameter: Size Matters

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Purpose: Renal tumor size influences the efficacy of radio frequency ablation but identification of confident size cutoffs has been limited by small numbers and short followup. We evaluated tumor size related outcomes after radio frequency ablation for patients with adequate (greater than 3 years) followup.

Materials and Methods: We identified 159 tumors treated with radio frequency ablation as primary treatment. Disease-free survival was defined as the time from definitive treatment to local recurrence, detection of metastasis or the most recent imaging showing no evidence of disease. Patients were evaluated with contrast enhancing imaging preoperatively, and at 6 weeks, 6 months and at least annually thereafter.

Results: Median tumor size was 2.4 cm (range 0.9 to 5.4) with a median followup of 54 months (range 1.5 to 120). Renal cell carcinoma was confirmed in 72% of the 150 tumors that had pre-ablation biopsy (94%). The 3 and 5-year disease-free survival was comparable at 92% and 91% overall, and was dependent on tumor size, being 96% and 95% for tumors smaller than 3.0 cm and 79% and 79%, respectively, for tumors 3 cm or larger ($p = 0.001$). Most failures (14 of 18) were local, either incomplete ablations or local recurrences. This is an intent to treat analysis and, therefore, includes patients ultimately found to have benign tumors, although outcomes were comparable in patients with cancer.

Conclusions: Radio frequency ablation treatment success of the small renal mass is strongly correlated with tumor size. Radio frequency ablation provides excellent and durable outcomes, particularly in tumors smaller than 3 cm. Of tumors 3 cm or larger, approximately 20% will recur such that alternative treatment techniques should be considered. However, most treatment failures are local and are often successfully treated with another ablation session.

Key Words: carcinoma, renal cell; ablation techniques; treatment outcome

Abbreviations and Acronyms

CT = computerized tomography
DFS = disease-free survival
IV = intravenous
NED = no evidence of disease
RCC = renal cell carcinoma
RFA = radio frequency ablation
SRM = small renal mass

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Study received institutional review board permission.

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See Editorial on page 1153.

NEPHRON sparing surgery has replaced radical nephrectomy as the gold standard treatment for small renal masses, largely due to its favorable impact on renal function and similar long-term cancer control rates.[1,2] This transition is especially timely given that rampant use of cross-sectional abdominal imaging has led to an increased incidental detection of SRMs.[3–6] These tumors tend to be smaller than symptomatic lesions, increasing their suitability for nephron sparing surgery. To reduce the morbidity of conventional partial nephrectomy techniques there has been persistent interest in the last decade in renal tumor ablative technologies, the most common of which are cryoablation and RFA. Potential advantages of ablative therapy

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include in situ treatment, absence of an ischemic insult to the remaining kidney, reduced blood loss, quicker recovery and possible outpatient management.

The kidney tumor ablation literature typically reports success rates without the distinction of tumor size beyond clinical stage T1a status. Several series suggest that renal tumor size influences the efficacy of RFA, but identification of size cutoffs has been limited by small numbers and short followup. For example, Gervais et al reported initial success rates of 100% for tumors 3 cm or smaller (with a mean of 1.1 ablation sessions) compared to 92% for tumors 3 to 5 cm (requiring a mean of 1.5 to 2.0 ablation sessions).[7] However, their series does not report outcomes beyond the initial detection of success. On the other hand, Ferakis et al reported a longer followup (mean 61.2 months) and found a 50% recurrence rate in tumors 4 cm or larger.[8] However, their conclusion was limited due to the overall cohort size being only 39 tumors. The commencement of our RFA program in 2000 provides a unique opportunity to confidently report longer term efficacy stratified by tumor diameter in a large series. In this study we analyze tumor size related outcomes for RFA, focusing on patients with long-term followup. Given the lack of consensus concerning the use and timing of tumor biopsy, we report outcomes for RFA of all enhancing SRMs, providing results for all tumors (intent to treat) as well as those confirmed to harbor renal cell carcinoma.

METHODS

Institutional review board permission was obtained to review our prospectively maintained database of kidney tumors and to identify patients who had undergone RFA of a SRM since 2000. To allow for adequate followup the query end date was selected as 36 months before study preparation. Patients were excluded from analysis if the tumor had been previously treated with a different modality or if the tumor was immediately excised after RFA (ie ablation assisted partial nephrectomy). Patients were also excluded if they had less than 36 months of followup unless they had a recurrence/incomplete ablation during that time. The reasoning for this decision was that no matter the subsequent followup, the patient will always have experienced a failure, whereas a disease-free patient with short followup may be incorrectly categorized and have recurrence at a later date. Patients were not excluded for having a hereditary predisposition to renal tumors because the goal of this investigation was to evaluate disease control based on tumor size. While these patients are at higher risk for de novo tumors, local control of treated tumors can still be adequately assessed.

Radio Frequency Ablation Technique

Our technique for the ablation of SRMs has been previously described.[9,10] In summary, the RITA® Medical Systems Model 1500 RF generator was used for percutaneous and laparoscopic ablations. The surgeon chose between these approaches based on tumor location. Anterior tumors and those located near adjacent organs or bowel were typically treated laparoscopically, while those more lateral or posterior were treated percutaneously. Percutaneous ablations were performed with the patient under general anesthesia and using CT guidance. Noncontrast CT was performed to confirm tumor position and anatomy with the patient in the prone position and then IV contrast was administered to delineate the tumor (fig. 1). A 20 gauge chiba finder needle was then placed percutaneously to identify an appropriate trajectory for the RFA probe. A 14 gauge Starburst® XL probe was then deployed along a similar trajectory to create an ablation zone approximately 5 to 10 mm beyond the tumor margin. Once CT confirmed appropriate tine deployment of the RFA probe, an 18 gauge Tru-Cut® biopsy needle was used to obtain 2

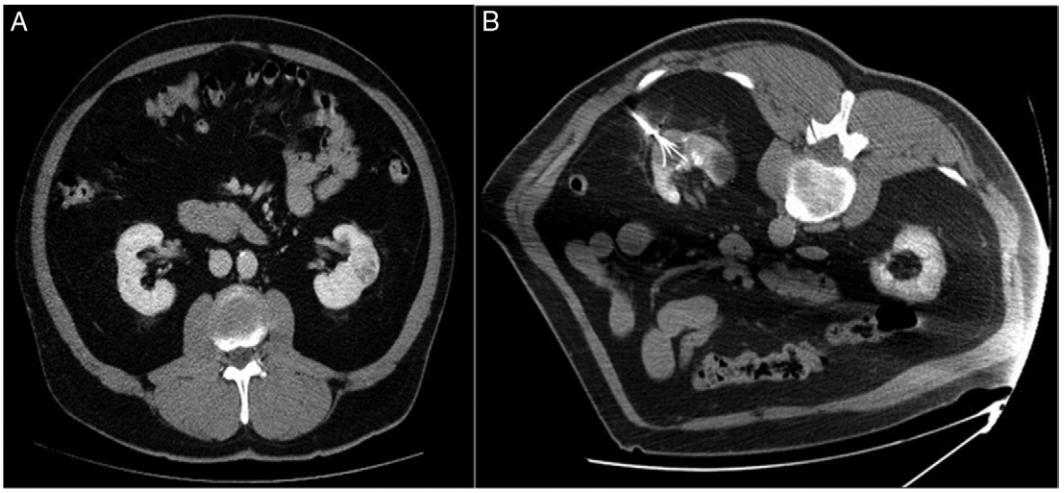

Figure 1. *A,* enhancing left renal mass. *B,* same renal mass with RFA probe tines in place. Patient is prone.