CLINICAL STUDY

Radiofrequency Ablation of T1a Renal Cell Carcinomas within Renal Transplant Allografts: Oncologic Outcomes and Graft Viability

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ABSTRACT

Purpose: To evaluate oncologic outcomes and graft viability after percutaneous RF ablation of renal cell carcinoma (RCC) developing within renal transplant allografts.

Materials and Methods: A single-institution, retrospective study reviewed all patients treated with RF ablation for RCC between February 2004 and May 2016. Ten patients were identified (age 49.6 y ± 12.6; 9 men, 1 woman) with 12 biopsy-confirmed RCC tumors within the allograft (all T1a, mean diameter 2.0 cm ± 0.7). Mean time from transplant to RCC diagnosis was 13.2 years ± 6.3. RF ablation was performed on an outpatient basis using conscious sedation. Procedural efficacy, complications, oncologic outcomes, and allograft function were evaluated. Statistical analysis with *t* tests and Pearson correlation compared allograft function before and after RF ablation and impact of proportional ablation size to allograft volume on function after ablation.

Results: Technical success rate and primary technique efficacy were 100% (12/12). No local or distant RCC progression was seen at mean follow-up of 54.3 months ± 38.7 (range, 9–136 months). Graft failure requiring hemodialysis or repeat transplantation occurred in 3 patients (26, 354, and 750 d after RF ablation), all of whom had glomerular filtration rate (GFR) < 30 mL/min/1.73 m^2 before ablation. For all patients, mean GFR 6 months after RF ablation (35.8 mL/min/1.73 m^2 ± 17.7) was not significantly different ($P = .8$) from preprocedure GFR (36.2 mL/min/1.73 m^2 ± 14.3). Proportional volume of allograft that was ablated did not correlate with immediate or long-term GFR changes. One patient died of unrelated comorbidities 52 months after ablation. No major complications occurred.

Conclusions: RF ablation of renal allograft RCC provided effective oncologic control without adverse impact on graft viability.

ABBREVIATIONS

GFR = glomerular filtration rate, RCC = renal cell carcinoma

The development of renal cell carcinoma (RCC) within transplant allografts is rare, with an estimated incidence of 0.18%–0.26% (1–3). A meta-analysis of renal allograft RCC treatment identified 267 de novo RCC tumors reported in 70 publications between 1992 and December 2014, most of which were case reports and small case series (2). Nephron-sparing treatment in transplant-dependent patients with allograft RCCs is preferred to achieve oncologic control while maintaining graft viability. Radiofrequency (RF) ablation has shown excellent outcomes for RCC within native kidneys, with 5-year survival rates of 90%–95% (4–6). However, the applicability of these results to patients with renal transplants cannot be assumed, as the histologic makeup of allograft RCCs differs from RCCs seen in native kidneys. Patients with renal transplants have a higher proportion of papillary subtype histology (43%–75% of RCC cases) (2,3,7). Furthermore, the impact of RF ablation on graft viability is unknown. This study evaluated the intermediate-term oncologic outcomes and graft viability from a single-center experience of RF ablation of 12 allograft RCC tumors. The transplant allograft function was

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evaluated to determine possible impact of RF ablation on graft viability.

MATERIALS AND METHODS

Institutional research ethics review board approval was obtained to perform this retrospective study. All renal RF ablation procedures performed in 355 patients between February 2004 and May 2016 were reviewed. The mean number of renal transplant surgeries performed at this institution during the study period was 153 kidneys/y ± 20 (range, 115–190 kidneys/y). Ten renal transplant patients (mean age 49.6 y ± 12.6; range, 28–66 y; 9 men and 1 woman) were identified with 12 de novo allograft RCC tumors (2.0 cm ± 0.7; range, 1.0–3.1 cm). All tumors were found incidentally during annual Doppler ultrasound (US) scanning for transplant surveillance. Of 10 patients, 9 were Eastern Cooperative Oncology Group 0 and 1 was Eastern Cooperative Oncology Group 1. Eight patients had solitary tumors, and 2 patients had synchronous tumors (mean R.E.N.A.L. Nephrometry score 6.5 ± 1.6; range, 4–10) (8). All patients had confirmed RCC on core biopsy. The mean time from transplantation to RCC diagnosis was 13.2 years ± 6.3 (range, 0.8–21.1 y). All patients had functioning renal transplants before RF ablation with immunosuppression regimens that included prednisone and 1 or a combination of the following agents: tacrolimus, cyclosporine, or mycophenolate. Patient demographics and tumor characteristics are listed in the Table.

Patients were selected for RF ablation after discussion at a biweekly multidisciplinary tumor board where other treatment options, such as active surveillance, partial nephrectomy, or transplantectomy, were considered. The institutional preference for patients with T1a renal tumors (< 4 cm) diagnosed after transplant and functioning allografts is thermal ablation therapy; at the time of this study, RF ablation was the only thermal therapy available at the institution.

All RF ablation procedures were performed by 1 operator (J.R.K.) with 17 years of RF ablation experience. The procedures were performed percutaneously on an outpatient basis with conscious sedation using intravenous fentanyl and midazolam. Immunosuppression medications were not modified before or after the procedure, and prophylactic antibiotics were not administered. The same multitined RF electrode system (LeVeen; Boston Scientific, Marlborough,

Table. Individual Patient and Tumor Characteristics

Sex	Age (y) at Diagnosis	Type of Transplant	RCC Subtype*	Tumor Diameter (cm)	Tumor Location†	Transplant Outcome
M	60	Cadaveric	Papillary, grade 2	3.1	Lower pole, exophytic, 4 mm	
M	45	Cadaveric	Papillary, grade 2	1.0	Interpolar, exophytic	Graft failure requiring repeat transplant 11.8 months after RF ablation
F	44	Living-related	Papillary, grade 2	2.9	Upper pole, exophytic, 7 mm	Graft failure requiring dialysis 25 months after RF ablation. Transplantectomy for benign adenomas on failed transplant
M	55	Living-related	Papillary, grade 1	3.0	Upper pole, exophytic, 6 mm	Died 51.6 months after RF ablation without chronic graft failure or identified RCC recurrence
M	59	Cadaveric	Papillary, grade 2	1.4, 1.7	Interpolar, exophytic, 1 mm and lower pole, exophytic, 3 mm	
M	50	Living-related	Papillary, grade 1	2.2	Lower pole, parenchymal, < 1 mm	
M	58	Cadaveric	Papillary, g rade 2	2.1, 1.8	Lower pole, exophytic, < 1 mm and interpolar, exophytic, < 1 mm	
M	28	Living-related	Tubulocystic, grade 1	1.5 cm	Upper pole, exophytic, 4 mm	Graft failure requiring dialysis 26 days after RF ablation.
M	31	Living-related	Papillary, grade 1	1.4 cm	Interpolar, mixed exophytic and endophytic, 14 mm	
M	66	Cadaveric	Papillary, grade 2	2.3	Interpolar, parenchymal, 3 mm	

F = female; M = male; RCC = renal cell carcinoma.
*From core biopsy.
†Pole, parenchyma location, minimum distance to renal collecting system.