CLINICAL STUDY

Percutaneous Cryoablation of Renal Cell Carcinoma with Sinus Vein Involvement Based on Preprocedural Imaging

Thomas D. Atwell, MD, A. Nicholas Kurup, MD, Stephen A. Boorjian, MD, John J. Schmitz, MD, R. Houston Thompson, MD, Bradley C. Leibovich, MD, and Grant D. Schmit, MD

ABSTRACT

Purpose: To assess feasibility, safety, and oncologic outcomes of cryoablation in treatment of renal cell carcinoma (RCC) with extension into adjacent renal sinus vein.

Materials and Methods: Review of an internally maintained renal ablation registry identified 7 patients (4 men and 3 women; median age 62 y; age range, 45–91 y) who underwent percutaneous cryoablation of RCC with imaging consistent with extension of tumor into an immediately adjacent renal sinus vein. Four of 7 (57%) patients had recurrent tumors following prior partial nephrectomy. Three of 7 patients (43%) had solitary kidneys.

Results: Median tumor size was 4.3 cm (range, 1.9–5.0 cm). Biopsy showed RCC in 6 of 7 patients. Technical success was achieved in 6 of 7 tumors (86%) There was a single Clavien grade 3 major complication. Median hospital stay was 1 night (range, 1–3 nights). Follow-up imaging performed in the 6 successfully treated patients at median 11 months (range, 2–101 months) showed no local tumor progression. In 2 patients with solitary kidneys, estimated glomerular filtration rate declined from 63 mL/min/1.73 m^2 to 45 mL/min/1.73 m^2 and 67 mL/min/1.73 m^2 to 40 mL/min/1.73 m^2 at 101 months and 12 months following treatment, respectively. Estimated glomerular filtration rate remained $>$ 60 mL/min/1.73 m^2 in the remaining patients.

Conclusions: In this small select group of patients, percutaneous cryoablation afforded a safe and, based on early outcomes, effective means of providing local control of locally invasive RCC. Percutaneous cryoablation may obviate the need for nephrectomy in similar patients.

ABBREVIATIONS

PN = partial nephrectomy, RCC = renal cell carcinoma

The current American Joint Committee on Cancer/Union for International Cancer Control staging of renal cell carcinoma (RCC) classifies tumors with extension into the main renal vein or muscle containing segmental veins as T3a (1). Although small case series have described partial nephrectomy (PN) for these masses with renal vein involvement, the current gold standard for treatment of locally advanced RCC is radical nephrectomy (2–5). At the present time, thermal ablation is formally regarded as a treatment alternative for patients with a localized T1a renal mass, although cryoablation has shown efficacy in the treatment of T1b renal masses (6–8). Success in treating these larger masses is predominately based on the synergy of multiple cryoprobes and the ability to safely generate lethal ice centrally in the kidney, in contrast to a recognized limitation of heat-based thermal techniques (9–13). The purpose of this study was to determine the safety and efficacy of cryoablation in the treatment of RCC with radiographic evidence of renal sinus vein involvement.

MATERIALS AND METHODS

This study was approved by the institutional review board. From January 2007 to October 2016, using a departmental cryoablation database, 7 unique patients were identified who

From the Departments of Radiology (T.D.A., A.N.K., J.J.S., G.D.S.) and Urology (S.A.B., R.H.T., B.C.L.), Mayo Clinic, 200 First Street SW, Rochester, MN 55902. Received March 26, 2017; final revision received and accepted August 10, 2017. Address correspondence to T.D.A.; E-mail: atwell.thomas@mayo.edu

A.N.K. received a research grant from Galil Medical (Arden Hills, Minnesota) and receives royalties from UpToDate (Waltham, Massachusetts). None of the other authors have identified a conflict of interest.

J Vasc Interv Radiol 2017; ■:1–7

http://dx.doi.org/10.1016/j.jvir.2017.08.008

Table 1. Patient and Tumor Characteristics

Patient	Age (y), Sex	Sporadic Tumor	Solitary Kidney	Prior Surgery on Ablated Kidney	Recurrence at PN Site	Indication for Ablation	Maximum Tumor Size (cm)
1	45, M	No	Yes	Yes	Yes	Prior TN	5.0
2	50, M	No	Yes	No	No	Prior TN	4.5
3	57, F	No	No	Yes	Yes	Prior PN	3.2
4	62, F	No	Yes	Yes	Yes	Prior TN	1.9
5	67, M	No	No	Yes	Yes	Prior PN	4.4
6	87, F	Yes	No	No	No	Medical comorbidity	4.3
7	91, M	Yes	No	No	No	Medical comorbidity	3.7

F = female; M = male; PN = partial nephrectomy; TN = total nephrectomy.

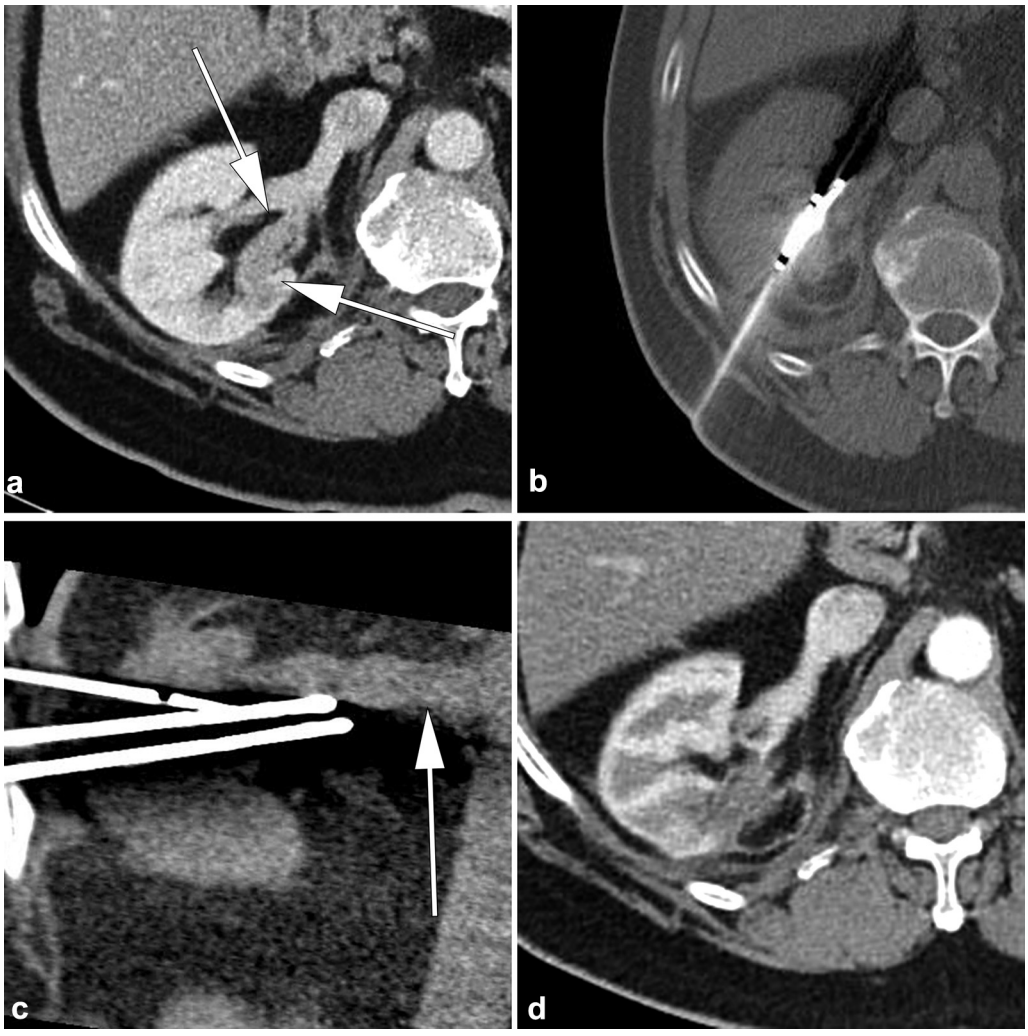

Figure 1. Patient with prior right PN for a grade 2 of 4 clear cell RCC. **(a)** Axial CT image with intravenous contrast administration shows a solid tumor extending into a posterior segmental renal vein (arrows). **(b)** CT image obtained during cryoablation shows 2 of 3 cryoprobes cannulating the tumor in the renal vein. **(c)** Oblique coronal reconstructed CT image shows the proximity of the cryoprobes to the main right renal vein (arrow). **(d)** Axial CT image with intravenous contrast administration obtained 17 months after treatment shows no recurrence of RCC.

were known to have renal sinus vein extension of their index renal mass based on contrast-enhanced imaging before ablation. Specifically, the index renal mass was seen to extend into a centrally located renal vein with adjacent fat. All patients were managed by physicians in the Department of Urology with thorough consultation regarding the risks and benefits of treatment options. Based on an initial consultation, patients were referred to a radiologist from a