

Case Report

Contrast-enhanced Computed Tomography-Guided Percutaneous Cryoablation of Renal Cell Carcinoma in a Renal Allograft: First Case in Asia

Ichiro Tsuboi^a, Motoo Araki^{a*}, Hiroyasu Fujiwara^b, Toshihiro Iguchi^b, Takao Hiraki^b, Naoko Arichi^c, Kasumi Kawamura^a, Yuki Maruyama^a, Yosuke Mitsui^a, Takuya Sadahira^a, Risa Kubota^a, Shingo Nishimura^a, Tomoko Sako^a, Atsushi Takamoto^a, Koichiro Wada^a, Yasuyuki Kobayashi^a, Toyohiko Watanabe^a, Hiroyuki Yanai^d, Masashi Kitagawa^e, Katsuyuki Tanabe^e, Hitoshi Sugiyama^e, Jun Wada^e, Hiroaki Shiina^c, Susumu Kanazawa^b, and Yasutomo Nasu^a

Departments of ^aUrology, ^eNephrology, Rheumatology, Endocrinology and Metabolism, Okayama University Graduate School of Medicine, Dentistry and Pharmaceutical Sciences, Departments of ^bRadiology, ^dPathology, Okayama University Hospital, Okayama 700-8558, Japan, ^cDepartment of Urology, Shimane University, Faculty of Medicine, Shimane 693-8501, Japan

Nephron-sparing treatment should be offered whenever possible to avoid dialysis in allograft cases. Cryoablation is a new treatment option for treating small-sized renal cell cancer (RCCs). We report a case of RCC arising in a kidney allograft treated by cryoablation. To our knowledge, this is the first case in Asia of RCC in a renal allograft treated using cryoablation. Contrast-enhanced CT-guided percutaneous renal needle biopsy and cryoablation were used to identify the RCC, which could not be identified by other techniques. The postoperative course was uneventful. Contrast-enhanced CT also showed no recurrence or metastases at the 6-month follow-up.

Key words: cryoablation, partial nephrectomy, renal cell carcinoma, renal allograft, renal transplantation

The incidence of renal cell cancer (RCC) in renal allografts is as low as 0.3% [1]. Nephron-sparing surgery is ideal for excising these tumors, whereas partial nephrectomy of a renal allograft is technically challenging. Cryoablation is a new treatment option to treat small-sized RCCs. We report a case of RCC in a kidney allograft treated by cryoablation. To our knowledge, this is the first case in Asia and ninth case worldwide of RCC in a kidney allograft treated with cyroablation.

Case Presentation

A 49-year-old man was diagnosed with nephrosclerosis by renal biopsy in 2006. His renal function gradually deteriorated, and he received hemodialysis from 2011 to 2012. He then underwent a living renal transplant from his younger brother's left renal for end-stage renal disease (ESRD) at another hospital. His family showed no history of renal cancer. The postoperative immunosuppression regimen consisted of tacrolimus, mycophenolate mofetil, and prednisolone. Renal func-

tion remained stable at 0.85 mg/dL. In 2017, a routine follow-up computerized tomography (CT) showed a 20-mm lesion in the right native kidney and a 12-mm lesion in the renal allograft (Fig. 1). The patient underwent a laparoscopic radical nephrectomy of his right kidney, with pathology demonstrating a type II papillary renal cell carcinoma (Fig. 2A). He was referred to our hospital for treatment of the renal tumor in the renal allograft. The tumor was very small and completely endophytic, making an ultrasound-guided renal needle biopsy impossible. The patient therefore underwent a contrast-enhanced CT-guided renal needle biopsy, with pathology showing a RCC (Fig. 2B). However, the tissue type could not be identified because the sample was too small.

Two months later, the patient underwent contrast-enhanced CT-guided cryoablation under intravenous sedation. Two cryoprobes were placed under contrast-enhanced CT guidance. Two 15-minute cycles of freezing and thawing were then performed (Fig. 3A, 3B). Before cryoablation his serum creatinine was 0.88 mg/dL, and LDH was 186 U/L, while on postoperative day 1, the serum creatinine had increased to 1.03 mg/dL and LDH to 518 U/L. No complications developed, and the patient's serum creatinine level remained stable during the admission. He was discharged on postoperative day 5. At the 6-month follow-up, his serum creatinine was 0.92 mg/dL and contrast-enhanced CT showed a 20-mm iceball with no enhancement, indicating no recurrence of the tumor or presence of metastases (Fig. 4).

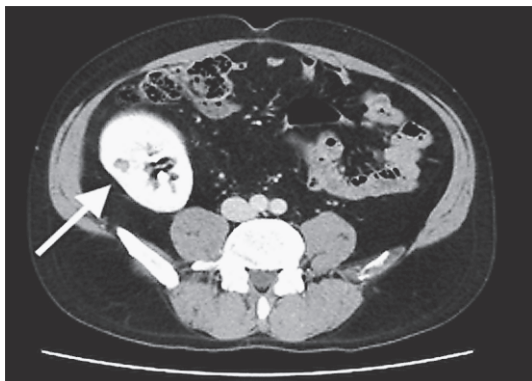
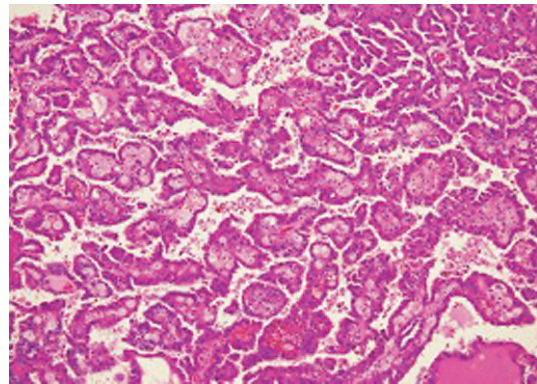


Fig. 1 Contrast-enhanced CT image of the tumor (axial view): The white arrow shows a hypodense lesion at the upper pole of the renal allograft.

(A)



(B)

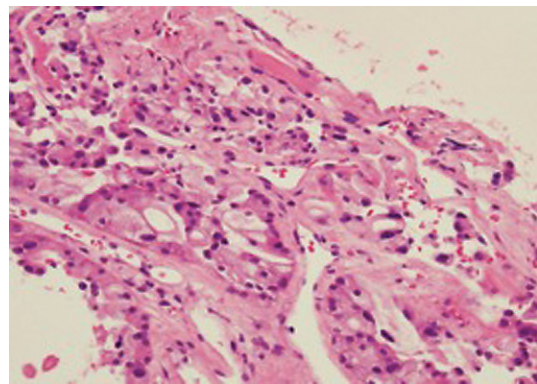


Fig. 2 **A**, Specimens by right nephrectomy: a type II papillary renal cell carcinoma showing papillary architecture with large, high-nuclear-grade cells; **B**, Specimens obtained by contrast-enhanced CT guided renal needle biopsy: Atypical cells with papillary pattern were positive for CK7, CD10, AMACAR. There was a possibility of its being papillary renal cell carcinoma, but the specimens were too small to identify the tissue type.

Discussion

This paper describes the first case in Asia of RCC in a renal allograft treated by cryoablation. Contrast-enhanced CT-guided percutaneous renal needle biopsy and cryoablation were used to identify and treat the RCC, which could not be identified using other modalities including ultrasound.

It has been reported that renal carcinomas make up 4.6% of post-renal transplant cancers [1]. That study on 7596 cases showed that the cancer developed in the diseased kidney in 222 patients and in the allograft in 24 patients [1]. The incidence of incidental renal cancer in a renal allograft is only 0.3% (24/7596); this explains the rarity of our case report of cryoablation for RCC in

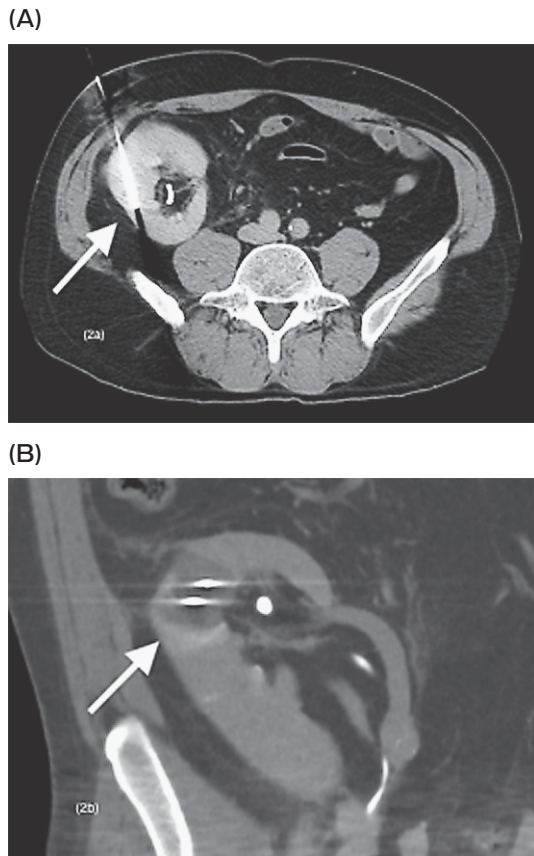


Fig. 3 **A**, Contrast-enhanced CT image of the tumor (axial view): The white arrow shows percutaneous cryoablation with contrast-enhanced CT; **B**, Contrast-enhanced CT image of the tumor (coronal view): The white arrow shows 2 cryoprobes inserted into the tumor of the renal allograft.



Fig. 4 Six-month post-op: The white arrow shows a 20-mm ice-ball with no enhancement after cryoablation.

a renal allograft [1-4]. Ours is only the ninth such case in the world and the first case in Asia. Patient sex, age, tumor diameter, guiding image, and authors are detailed in Table 1 [2-5].

When there is the only functioning kidney in patients with a renal tumor, it is important to attempt nephron-sparing treatment including partial nephrectomy, radiofrequency ablation, and cryoablation. Partial nephrectomy of a renal allograft is technically challenging because the renal hilum may be surrounded by desmoplastic tissue. The patients are also immunocompromised, making their surgical risk considerably higher than that of immunocompetent patients. A systematic review and meta-analysis of 3974 RCC patients, which are not only in a renal allograft, demonstrated that compared with a partial nephrectomy, thermal ablation including cryoablation showed no significant difference in local recurrence or metastases, and was associated with a lower morbidity rate and a smaller reduction in eGFR [6]. Moreover, the most recent report published in 2018 found no significant difference in complications, renal function outcomes, and oncologic outcomes between partial nephrectomy and percutaneous cryoablation for patients with a tumor in a solitary kidney [7]. Radiofrequency ablation is a good treatment option; however, it is not approved by Japan's national health insurance system. Cryoablation is the only focal therapy for treatment of RCC approved by the national health insurance system in Japan. Accordingly, our patient elected to undergo cryoablation. If it is difficult to treat RCC with contrast-enhanced CT-guided cryoablation due to allergies to contrast medium or renal dysfunction, MRI-guided cryoablation should be considered [3].

Our case had two different types of renal cancers, one in the right native kidney and the other in the renal allograft. It would be interesting to know whether they arose from the same origin or were independent *de novo* cancers. One case report showed metachronal RCC occurring in an allograft and a native kidney. The researchers discovered that the donor was the origin of the RCC in the allograft while the origin of the RCC in the native kidney was not identified [8]. Unfortunately, our case did not undergo genetic examination of the 2 tumors.

Table 1 Nine cases of renal cell tumor in an allograft treated by cryoablation

Authors [Reference]	Published year	Country	Sex/ Age (year)	Tumor Diameter (mm)	Guided image	Histopathologic Findings
Shingleton, WB et. al. [3]	2002	USA	M/81	15	MRI	Clear cell carcinoma
Hruby, GW et. al. [2]	2006	Columbia	M/50	32	US	Oncocytic neoplasm
Silvestri, T et. al. [4]	2014	Italy	F/88	13	CT	Papillary carcinoma Type I
Cornelis, F et. al. [5]	2011	One of France, Belgium, Italy, England, and USA	M/50 F/55 M/40 F/37 F/71	30 35 18 20 15	One of CT (3), US(1), and CT/US(1)	Papillary carcinoma Clear cell carcinoma Papillary carcinoma Clear cell carcinoma Papillary carcinoma
Tsuboi, I et. al.	Present report	Japan	M/61	12	CT	Renal cell carcinoma, (tissue type was not identified)

MRI, magnetic resonance imaging US, ultrasonography CT, computed tomography.

Conclusion

We report the first case in Asia of RCC in a renal allograft treated by cryoablation. Contrast-enhanced CT-guided cryoablation is a good technique for identifying and treating small renal tumors that cannot be identified by other methods.

Acknowledgments We gratefully acknowledge the members of the Okayama University Urology and Radiology departments.

References

1. Penn I: Primary kidney tumors before and after renal transplantation. *Transplantation* (1995) 59: 480–485.
2. Hruby GW, Fine JK and Landman J: Ultrasound-guided percutaneous ablation of a renal mass in a renal allograft. *Urology* (2006) 68: 891e5–891e6.
3. Shingleton WB and Sewell PE: Percutaneous cryoablation of renal cell carcinoma in a transplanted kidney: *BJU International* (2002) 90: 137–138.
4. Silvestri T, Stacul F, Bertolotto M, Artero M and Siracusano S: Percutaneous cryoablation of a renal cell carcinoma in a transplanted kidney. *Can J Urol* (2014) 21: 7390–7392.
5. Cornelis F, Buy X, André M, Oyen R, Bouffard-Vercelli J, Blandino A, Auriol J, Correas J, Pluvinage A, Freeman S, Solomon S and Grenier N: De Novo Renal Tumors Arising in Kidney Transplants: Midterm Outcome after Percutaneous Thermal Ablation. *Radiology* Radiological Society of North America, Inc. (2011) 260: 900–907.
6. Rivero JR, La Cerda De J, Wang H, Liss MA, Farrell AM, Rodriguez R, Suri R and Kaushik D: Partial Nephrectomy versus Thermal Ablation for Clinical Stage T1 Renal Masses: Systematic Review and Meta-Analysis of More than 3,900 Patients *J Vasc Interv Radiol* (2018) 29: 18–29.
7. Bhindi B, Mason RJ, Haddad MM Boorjian SA, Leibovich BC, Atwell TD, Weisbrod AJ, Schmit GD and Thompson RH: Outcomes After Cryoablation Versus Partial Nephrectomy for Sporadic Renal Tumors in a Solitary Kidney: A Propensity Score Analysis. *Eur Urol* (2018) 73: 254–259.
8. Tuzuner A, Çakir F, Akyol C, Çelebi ZK, Ceylaner S, Ceylaner G, Sengul S and Keven K: Nephron-sparing surgery for renal cell carcinoma of the allograft after renal transplantation: report of two cases. *Transplant Proc* (2013) 45: 958–960.