Radiology Case Reports 17 (2022) 4064–4068

Available online at www.sciencedirect.com

ScienceDirect

journal homepage: www.elsevier.com/locate/radcr

Case Report

Urinoma formation following renal mass cryoablation treated with nephroureteral stent placement☆

Megan E. Sweeney, BS[a,*], *Ryan M. Davis, MD*[b], *Ambarish P. Bhat, MD*[b], *Zain M. Khazi, MD*[b], *Katie Murray, MD*[c]

[a] *School of Medicine, University of Missouri, One Hospital Dr, Columbia, MO 65212, USA*
[b] *Section of Vascular and Interventional Radiology, Department of Radiology, University of Missouri, One Hospital Dr, Columbia, MO 65212, USA*
[c] *Department of Urology, University of Missouri, One Hospital Dr, Columbia, MO 65212, USA*

ARTICLE INFO

Article history:
Received 27 July 2022
Accepted 31 July 2022

Keywords:
Cryoablation
Renal mass
Urinoma
Nephroureteral stent

ABSTRACT

Renal cryoablation (CA) has become an accepted treatment option for patients with small renal tumors and co-morbidities that make them less favorable for surgical intervention. Complications from renal CA have been previously reported and are generally associated with increasing size and central location of the tumor. Ureteral injury from renal CA, although rare, can be difficult to manage and may require complex surgeries in patients who are poor surgical candidates to begin with. We report a case of a renal mass CA complicated by proximal ureteral necrosis and transection, treated with multiple minimally invasive procedures ultimately resulting in successful bridging of the necrotic segment with nephroureteral stent and thus avoiding major surgery.

Introduction

Cryoablation (CA) has become a preferred treatment for small renal masses in patients who are not ideal candidates for surgical resection [1]. Current American Urologic Association guidelines recommend nephron-sparing approaches for patients with solid renal masses who have known familial renal cell carcinoma or comorbidities likely to impact renal function in the future such as severe hypertension or diabetes mellitus, among other complicating risk factors [2]. CA is generally well tolerated with most associated complications being mild, including pain and paresthesia at probe insertion site. More serious complications are reported at a low rate but can include hemorrhage at the probe insertion site, perinephric hematoma, injury to the collecting system and ureter, cardiovascular events, and infection [1,5]. Based on limited studies and meta-analyses, complications of renal CA have ranged

☆ Competing Interests: The authors declare that they have no competing interests. No third party was involved in neither the influence nor outcome of this article.

* *Corresponding author.*

https://doi.org/10.1016/j.radcr.2022.07.113

Fig. 1 – Preprocedure CT: Coronal CT demonstrated 3.7 cm left solid renal mass (white arrow).

from 2.8% to 23.5% [3–6], with increasing tumor size identified as an independent risk factor for increased complications [5]. Here we report a case of a renal mass CA complicated by proximal ureteral necrosis and transection, treated with multiple sequential minimally invasive procedures ultimately resulting in successful bridging of the necrotic segment with a nephroureteral stent and thus avoiding major surgery.

Case presentation

A 67-year-old Caucasian female initially presented with a 4-day history of worsening abdominal pain due to recurrent small bowel obstruction. Her past medical history was significant for congestive heart failure, cerebrovascular events, ventral hernia, gout, lymphedema, multiple DVTs, and type 2 diabetes mellitus. She was a former smoker with 20+ pack/year history. A Computed Tomography (CT) scan performed as a part of her work up identified an incidental 3.7 cm left inferior pole exophytic solid renal mass (Fig. 1). Urology service was consulted to discuss management options.

At her initial appointment, the patient was urologically asymptotic including no history of gross hematuria. Family history was significant for a sibling diagnosed with renal cell carcinoma in their 30s which was successfully treated with surgical resection. Due to multiple comorbidities, the patient

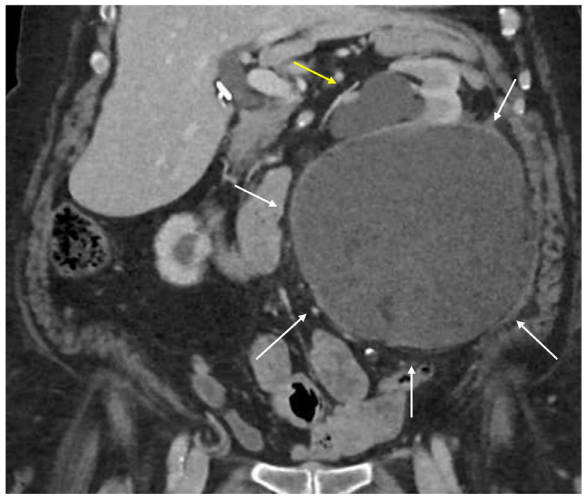

Fig. 3 – Follow-up CT: Coronal CT demonstrates large retroperitoneal urinoma (white arrows) and left hydroureteronephrosis (yellow arrow).

was determined to have low surgical fitness with high-risk for surgical complications and was referred to Interventional Radiology for biopsy and CA.

Approximately one month later, the patient was scheduled for a CT guided biopsy and CA of the renal mass. Preliminary CT scan on the day of the procedure demonstrated enlargement of the partially exophytic left inferior pole renal mass, now measuring 4.5 cm. To ensure a safe ablation, appropriate measures were taken to avoid injury to surrounding structures by performing a hydrodissection to create a window between the bowel and the mass using intermittent CT fluoroscopic guidance. Subsequently, a total of four 13-gauge and one 17-gauge CA probes were passed directly through the left inferior renal mass from a posterolateral approach. CT confirmed position of the probes for adequate ablation zone (Fig. 2). CA was performed as per the manufacturer's recommendations to obtain an ice ball of the desired size. Intraprocedural CT demonstrated inclusion of the entire lesion within the ice ball without apparent involvement of the adjacent colon or other vital structures. Immediate postprocedure CT examination demonstrated no significant hemorrhage or other complications. Core biopsies obtained during the procedure subsequently revealed presence of Fuhrman grade 2 clear-cell renal carcinoma.

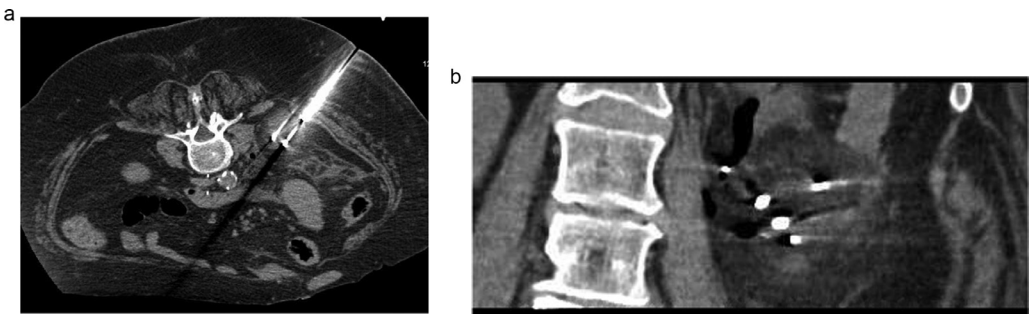

Fig. 2 – (A & B) Intraprocedure CT: Cryoablation probes within the left inferior pole renal mass.

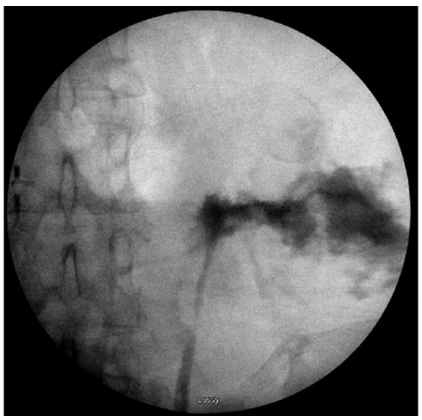

Fig. 4 – Intraoperative ureterogram: Retrograde urogram with contrast extravasation into the urinoma without opacification of the renal pelvis.

At 3-month follow up, the patient reported sensations of numbness and tingling of her left groin and thigh. These symptoms began following the procedure but improved over the last 3 months and she was otherwise in a normal state of health. CT abdomen and pelvis performed at follow up demonstrated a left inferior renal pole ablation cavity without evidence of abnormal contrast enhancement in the renal mass. However, a new 20 × 10 × 13 cm left retroperitoneal fluid collection causing anterior displacement of the kidney and moderate hydronephrosis with apparent connection to a lower pole calyx was identified (Fig. 3). After discussion with the Urology service, the patient was scheduled to undergo concurrent retrograde ureteral stent and percutaneous urinoma drainage.

At the time of cystoscopy and left retrograde pyelogram it was apparent that there was extravasation of contrast at the area of the proximal left ureter (Fig. 4). There appeared to be no communication between the proximal ureter and the renal pelvis, preventing placement of a ureteral stent. A left perinephric drainage catheter was placed in the fluid collection and fluid was sent for a creatinine and confirmed that the fluid collection was urine. It was planned for the patient to continue perinephric drainage for several weeks which would be eventually followed by left nephrostomy placement.

Fig. 6 – Nephroureteral stent placement with persistent extravasation (white arrow).

Approximately 2 weeks following the drainage catheter placement, the patient returned for placement of a left nephrostomy tube and attempted crossing of the ureteral defect. Access was obtained in the superior pole of the kidney to facilitate passage of the wire down the ureter. However, attempts to cross the ureteral defect were unsuccessful as the wire continued to curl within the retroperitoneum (Fig. 5). The decision was made to place a nephrostomy tube with reattempt at stent placement in the future.

Three weeks later, a combination procedure was performed with retrograde and antegrade access by urology and

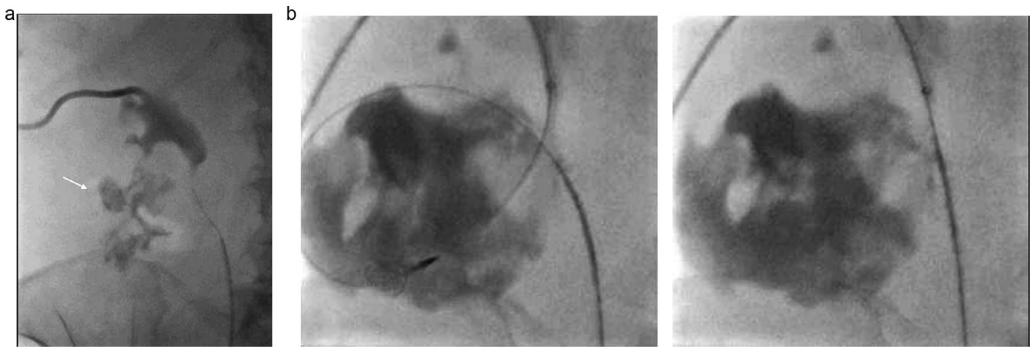

Fig. 5 – (A) Antegrade nephogram redemonstrates extravasation into retroperitoneum (white arrow). (B) Coiling of wire within the retroperitoneum despite multiple attempts to canalize the distal ureter.

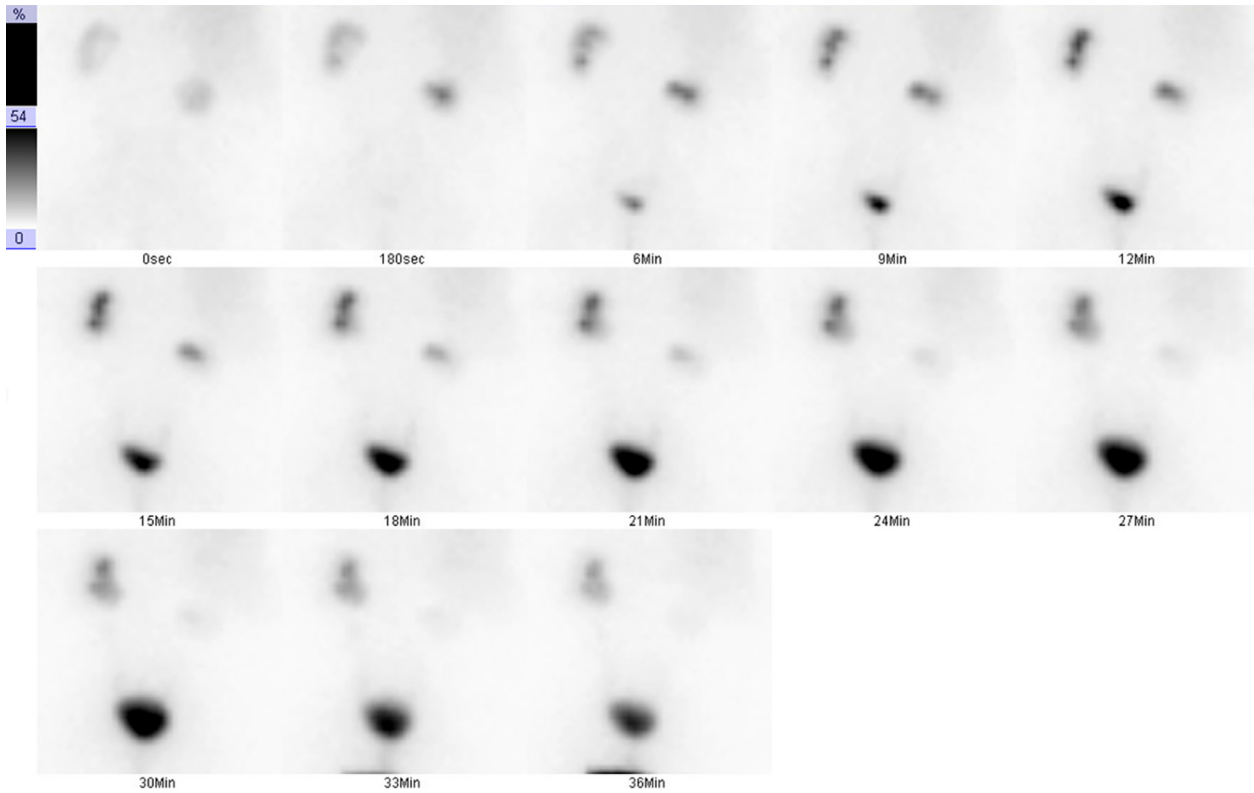

Fig. 7 – Nuclear medicine renal scan demonstrates early uptake of radiotracer in bilateral kidneys with delayed emptying on the left kidney with moderate hydronephrosis.

interventional radiology, respectively. A cystoscopy was performed, and a sensor wire was placed through the left ureteral orifice into the area of the defect and confirmed with fluoroscopy. At this time an antegrade nephrostogram through the existing nephrostomy tube demonstrated nondilated renal collecting system with persistent leak from the inferior pole calyx, filling a retroperitoneal urinoma, and complete occlusion of the proximal ureter. From the antegrade approach, a 6F vascular sheath was placed over the wire. A 5F Kumpe catheter and Glidewire were advanced through the sheath and used to penetrate the obstructed proximal ureter. The wire was then intermittently manipulated within the retroperitoneal urinoma and towards the retrograde ureteral wire placed by the urology service. The potential space of the drained urinoma was injected with saline to create room for snaring the retrograde wire. Working through the sheath, a 1.5 cm Ensnare was advanced and used to snare the retrograde placed ureteral wire in the retroperitoneum.

Once through and through wire access was established from the antegrade sheath into the bladder, a catheter was advanced into the bladder and the position was confirmed by injection of contrast under fluoroscopy. An 8F × 24 cm nephroureteral stent was placed with the distal pigtail formed in the bladder lumen and the proximal pigtail formed in the renal collecting system (Fig. 6). Injection of contrast confirmed position, with contrast flowing briskly down the stent into the bladder lumen.

The nephroureteral stent was subsequently internalized by the Urology service to an indwelling ureteral stent. The patient continues to have her stent changed by the urology service every 3-4 months. Retrograde pyelogram at each stent change shows severe stenosis of the proximal ureter. Ureteral balloon dilation has been performed up to 18F but has been unsuccessful in keeping the stricture open without a stent in place. A recent nuclear medicine renal scan showed 57.6% function from the left kidney (Fig. 7), demonstrating preserved renal function and appropriate treatment with continued stent changes. Based on the patient's comorbid conditions, shared decision making has been employed to discuss surgical repair of this proximal ureteral stricture and it has been decided to continue with indwelling stent changes for left kidney drainage.

Discussion

CA has become a preferred treatment for small renal masses in patients with low surgical fitness [1]. Complication rates following CA are low, reported in an average of 3% of cases [6,7]. Consequently, due to the low rates of complications, there is minimal literature reporting best treatment of uncommon complications following CA of renal masses. We present here a case of a rare complication of CA causing complete disruption of the proximal ureter.

The ureters are highly susceptible to iatrogenic injury, especially from gynecologic or urologic surgeries, due to their proximity to many significant abdominopelvic structures. The

distal portion is implicated in 91% of ureteral iatrogenic injuries, while proximal regions are far less commonly affected, accounting for only 2% of iatrogenic ureteral injuries [10]. Urinomas specifically are a rare injury that most often result from blunt or penetrating trauma and only uncommonly result from a surgical procedure [8,9].

There have been inconsistent reports regarding best treatment practices for delayed diagnosis of a ureteral injury with the management largely depending on the extent and location of the injury, as well as the patient's overall condition. First line treatment options for severe proximal ureteral injuries historically have included ureteroureterostomy, completed by open or laparoscopic repair [10,11]. Unfortunately, for mid-to-proximal ureter injuries, such as in this case, this treatment has been associated with further complications such as necrosis, stricture, leak, and fistula formation [10]. Reapproximation of the ureter after complete transection can be difficult and therefore this case is representative of the necessary collaboration between urology and interventional radiology for management of mid-proximal ureteral injuries.

Few comparisons have been made between open and minimally invasive management techniques for delayed ureteric injuries, primarily due to the rarity of the condition [10].

Among the relatively small number of reports on iatrogenic ureteral injury, to the best of our knowledge this is the first report of a renal mass CA complicated by formation of urinoma secondary to proximal ureter transection managed entirely by minimally invasive procedures, without resorting to open or laparoscopic surgical intervention despite prolonged complications. Compared to conventional surgical management, this minimally invasive approach has been associated with decreased postoperative pain, shorter hospitalization, reduced recovery time, and improved cosmesis [10] especially for those with low surgical fitness, such as the patient described here, preventing further morbidity. Further considering that this patient presented to her initial 3-month follow up with only minor neuropathic symptoms and without a definite timeframe of when the ureteral injury occurred, this case highlights the importance of consistent follow up imaging after CA.

Patient consent

Informed consent was obtained from the patient.

REFERENCES

[1] Kapoor A, Wang Y, Dishan B, Pautler SE. Update on cryoablation for treatment of small renal mass: oncologic control, renal function preservation, and rate of complications. Curr Urol Rep 2014;15(4):396. doi:10.1007/s11934-014-0396-3.

[2] Campbell SC, Clark PE, Chang SS, Karam JA, Souter L, Uzzo RG. Renal mass and localized renal cancer: evaluation, management, and follow-up: AUA guideline: part I. J Urol 2021;206(2):199–208. doi:10.1097/JU.0000000000001911.

[3] Haramis G, Graversen JA, Mues AC, Korets R, Rosales JC, Okhunov Z, et al. Retrospective comparison of laparoscopic partial nephrectomy versus laparoscopic renal cryoablation for small (<3.5 cm) cortical renal masses. J Laparoendosc Adv Surg Tech A 2012;22(2):152–7. doi:10.1089/lap.2011.0246.

[4] Sidana A, Aggarwal P, Feng Z, Georgiades CS, Trock BJ, Rodriguez R. Complications of renal cryoablation: a single center experience. J Urol 2010;184(1):42–7. doi:10.1016/j.juro.2010.03.013.

[5] Iannuccilli JD, Dupuy DE, Beland MD, Machan JT, Golijanin DJ, Mayo-Smith WW. Effectiveness and safety of computed tomography-guided radiofrequency ablation of renal cancer: a 14-year single institution experience in 203 patients. Eur Radiol 2016;26(6):1656–64. doi:10.1007/s00330-015-4006-7.

[6] Aoun HD, Littrup PJ, Jaber M, Memon F, Adam B, Krycia M, et al. Percutaneous cryoablation of renal tumors: is it time for a new paradigm shift? J Vasc Interv Radiol 2017;28(10):1363–70. doi:10.1016/j.jvir.2017.07.013.

[7] Knox J, Kohlbrenner R, Kolli K, Fidelman N, Kohl MP, Lehrman E, et al. Intermediate to long-term clinical outcomes of percutaneous cryoablation for renal masses. J Vasc Interv Radiol 2020;31(8):1242–8. doi:10.1016/j.jvir.2020.02.021.

[8] Esparaz AM, Pearl JA, Herts BR, LeBlanc J, Kapoor B. Iatrogenic urinary tract injuries: etiology, diagnosis, and management. Semin Intervent Radiol 2015;32(2):195–208. doi:10.1055/s-0035-1549378.

[9] Goldwasser J, Wahdat R, Espinosa J, Lucerna A. Urinoma: prompt diagnosis and treatment can prevent abscess formation, hydronephrosis, and a progressive loss of renal function. Case Rep Emerg Med 2018;2018:5456738. doi:10.1155/2018/5456738.

[10] Abboudi H, Ahmed K, Royle J, Khan MS, Dasgupta P, N'Dow J. Ureteric injury: a challenging condition to diagnose and manage. Nat Rev Urol 2013;10(2):108–15. doi:10.1038/nrurol.2012.254.

[11] Titton RL, Gervais DA, Hahn PF, Harisinghani MG, Arellano RS, Mueller PR. Urine leaks and urinomas: diagnosis and imaging-guided intervention. Radiographics 2003;23(5):1133–47. doi:10.1148/rg.235035029.