Saline Mobilization of the Colon during Percutaneous Renal Cryoablation

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ABSTRACT

A 62-year-old woman with a history of multiple abdominal surgeries underwent computed tomography–guided percutaneous renal cryoablation for a 1.5-cm enhancing left renal mass. We describe the technique of salinoma formation to displace the colon away from the tumor to avoid colonic injury during cryoablation.

KEYWORDS: Cryoablation, salinoma, percutaneous

Objectives: Upon completion of this article, the reader should be familiar with the technique of saline injection to mobilize various structures during percutaneous procedures, specifically with percutaneous renal cryoablation.

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Due to advances in abdominal imaging techniques and their widespread use in clinical practice, there has been an increase in the incidence of renal tumors and a tendency to smaller lesions.^{1,2} Because the natural history of these small tumors is highly unpredictable and up to 30% of lesions < 4 cm are benign,³ minimally invasive techniques are gaining acceptance as an alternative to traditional surgical procedures, particularly among the elderly and those with medical comorbidities. Initial results with percutaneous cryoablation are promising.^{4–6} However, patient anatomy can often make percutaneous access to renal tumors difficult or even impossible. We present a case during which saline injection was used to mobilize the colon away from a renal mass.

CASE REPORT

A 62-year-old woman with a history of hypertension and multiple abdominal surgeries complained of left flank

pain. Computed tomography (CT) demonstrated a 1.5-cm enhancing exophytic mass in the lower pole of the left kidney (Fig. 1). Her complex surgical history included a ventral hernia repair during which a large piece of mesh was placed over a portion of the anterior abdominal wall, making a transperitoneal or even a retroperitoneal approach to the tumor difficult. The peripheral, exophytic nature of her tumor and its small size made her an excellent candidate for CT-guided percutaneous cryoablation.

The patient was brought to the interventional radiology suite and placed under conscious sedation. CT images obtained in the prone position confirmed her left renal mass, although the tumor was noted to be < 1 cm away from the descending colon (Fig. 2). Right lateral decubitus repositioning did not significantly alter the distance between the colon and the renal mass (Fig. 3). The decision was made to create a salinoma to allow safer access to the tumor.

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Figure 1 Contrast-enhanced computed tomography in supine position demonstrates a 1.4×1.3 cm exophytic enhancing mass in the lower pole of the left kidney.

Figure 2 Noncontrast computed tomography image obtained in the prone position confirmed the descending colon was < 1 cm away from the tumor.

Figure 3 Decubitus repositioning did not alter the distance between the renal tumor and the colon.

Figure 4 A 22-gauge needle is inserted in between the colon and the tumor.

Under sterile conditions, a 22-gauge Temno Chiba Fine Needle Aspiration (Cardinal Health, McGraw Park, IL) was advanced with CT guidance into the space between the tumor and the colon (Fig. 4). Next, 500 mL of sterile saline was injected into this space, displacing the bowel ~ 3 cm away from the renal tumor (Fig. 5). Renal cryoablation was then performed using three 17-gauge cryoprobes and two freeze/thaw cycles. The patient tolerated the procedure well and was discharged home on postprocedure day 1.

DISCUSSION

Uchida et al were the first to perform percutaneous cryoablation for renal tumors in 1995 using a nitrogen-based system for cooling and a 6.8-mm diameter cryoprobe.⁷ Argon has now become the preferred cooling agent because it allows for smaller probes and more

Figure 5 Sterile saline is injected between the adjacent structures, displacing the colon > 3 cm from the tumor. Note: Cryoprobe is now safely in the tumor.

precise control of the ice-ball size during freezing cycles.⁸ In general, argon gas is used to cool the probe to -196°C , with cell death reliably occurring at -20°C .⁹ Imaging modalities used for percutaneous cryotherapy have included CT, magnetic resonance imaging (MRI), and ultrasound (US). For most practitioners CT is the preferred method because it is widely available, allows intraprocedural monitoring of cryoprobe placement from three fixed dimensions, and easily distinguishes the cryoprobes from adjacent structures such as bowel and ureter. Although MRI provides high-resolution, dynamic images of the ice ball and surrounding structures that can be reconstructed in multiple planes, intraoperative MRI systems are scarce, expensive, and require special MR-compatible probes.⁹

Thermal injury to surrounding organs, especially bowel, is a known complication of renal cryotherapy. Silverman et al reported the development of a colonic abscess and fistula in one patient due to inadvertent freezing of adjacent colon during percutaneous cryotherapy.¹⁰ Because the ice-ball edge must extend ~ 1 cm from the tumor margin to ensure -40°C is reached, ensuring complete tissue destruction,¹¹ adequate displacement of the kidney from surrounding structures is a necessity. Although repositioning of the patient is often of benefit in separating the colon from the renal lesion, occasionally this does not separate the two adequately. The instillation of saline can be used effectively to this end.

Several other investigators have reported on the technique of saline installation to facilitate percutaneous procedures. Silverman et al previously reported using the injection of sterile normal saline to displace the colon away from a renal tumor during MR-guided percutaneous cryotherapy.¹⁰ Saline infusions have also been used to limit diaphragmatic injury during radiofrequency ablation of liver lesions when injected subphrenically,¹² and to facilitate an extrapleural approach during mediastinal lymph node biopsy.¹³ In 2005, Nk and colleagues described a case of a pelvic kidney that was safely accessed with the aid of retrocolic saline injection.¹⁴ The technique of salinoma mobilization has been used with success in a variety of percutaneous procedures and will become a valuable tool in the interventionalist's armamentarium.

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