INTRODUCTION

Image-guided tumor ablation has been an increasingly accepted and utilized treatment modality for selected patients with a variety of tumor types because of its high local control rate and minimal invasiveness. Initially, open or laparoscopic approaches were preferentially used, but as the decrease in probe diameter, a percutaneous approach has become much more common. Percutaneous techniques allow the use of CT, sonography (US), or MRI guidance to visualize the tumor, the ice ball, and surrounding structures with a high degree of precision and is less contrast than surgical techniques. In fact, comparative studies have shown that the percutaneous approach is equally efficacious with fewer major complications, shorter hospital stays, and decreased cost (Hinshaw, AJR. 2008; Bandi. J endourol 2008, Hui. JVIR 2008). This has led to the percutaneous approach being utilized for treatment of tumors in the kidney, liver, and prostate. The percutaneous approach has also allowed the use of CT, sonography (US), and MRI guidance to visualize the tumor, the ice ball, and surrounding structures with a high degree of precision and is less contrast than surgical techniques. In fact, comparative studies have shown that the percutaneous approach is equally efficacious with fewer major complications, shorter hospital stays, and decreased cost (Hinshaw, AJR. 2008; Bandi. J endourol 2008, Hui. JVIR 2008). This has led to the percutaneous approach being utilized for treatment of tumors in the kidney, liver, and prostate.

RESULTS

101 percutaneous renal cryoablations were performed at our institution during the study. Eight patients underwent hydrodissection using D5W doped with iodinated contrast and seven patients had hydrodissection using D5W without contrast. Mean age was 62 years and mean tumor size was 3.1 ± 1.2 cm.

MATERIALS AND METHODS

- Retrospective review of all percutaneous renal cryoablations performed at our institution over a 7-year period (2003 to 2010)
- Medical records and imaging studies were reviewed
- Demographic data, tumor size, procedural data (including the use of hydrodissection), and follow-up data were extracted and recorded
- Study group: Patients who had hydrodissection with D5W doped with iodinated contrast
- Hydrodissection performed by placing a 26-guage introducer needle into the space between the tumor and the adjacent normal tissue and the fluid is infused as necessary
- Adequate displacement was achieved when the tumor was completely encompassed by the iceball (Figure 3).
- The ablation was technically successful with the iceball completely encompassing the tumor (arrowhead) and follow up imaging showed no evidence of injury to either structure, or local tumor progression.
- Fluid resorption can occur over time
- Average displacement was 2.7 cm (range 2.2-3.5 cm)
- Average volume of infused fluid was 389 mL (range 100-1000 mL)
- Average attenuation of the hydrodissection fluid was 305 HU (range 267-383 HU) as compared to an average of 48 HU (range 46-74 HU) for the kidney

DISCUSSION

Vulnerable structures are frequently located in close proximity to an anticipated zone of ablation, particularly in the kidney. Non-target “collateral” thermal damage to these structures can have devastating consequences, such as bowel injury and perforation. Other structures at risk include the ureter, gallbladder, pancreas, diaphragm, and body wall/paraspinal musculature and associated neurovascular bundles. Multiple techniques have been developed to increase the safety and efficacy of percutaneous ablation by allowing displacement of and insulation for adjacent structures. These include: traction displacement with the cryoprobe (Figure 4), pyeloperfusion (Figure 5), and hydrodissection, among others.

Hydrodissection can be an effective mechanism for the displacement of vulnerable structures during percutaneous ablation and we have used this technique for several years. However, as a practical matter, when straight D5W is utilized for this purpose, we have found that adding iodinated contrast to the fluid can increase visibility and safety of hydrodissection. We describe our experience using contrast-doped 5% dextrose in water (D5W) for hydrodissection prior to percutaneous renal cryoablation.

CONCLUSION

- Organ’s displaced included colon (n=5), small bowel (n=3), pancreas (n=1) and in one case both the colon and anterior wall were displaced
- Average displacement was 2.7 cm (range 2.2-3.5 cm)
- Average volume of infused fluid was 389 mL (range 100-1000 mL)
- Average attenuation of the hydrodissection fluid was 305 HU (range 267-383 HU) as compared to an average of 48 HU (range 46-74 HU) for the kidney

- No complications and no injuries to adjacent structures were encountered
- No recurrences were noted with a mean follow-up of 5.4 months
- Optimal concentration of iodinated contrast was ~2% w/v

The use of contrast-doped D5W for hydrodissection allows for safe mobilization of adjacent structures and improved differentiation of adjacent structures from the renal tumor, thus improving the safety and efficacy of the procedure. In our practice, this has led to more aggressive patient selection and safer percutaneous procedures (Figure 7).