

Percutaneous Renal Cryoablation

Shauna Aiena and Lynn Blazaskie, M.S.,R.T. (R)

Introduction

Interventional Radiology (IR) is an advanced imaging modality that utilizes a sterile environment to intervene and treat a disease process therapeutically. IR is able to reduce hospital stays by avoiding surgery while also reducing medical costs. IR consists of two parts which are interventional and radiography. The interventional part is described as using wires and catheters to improve a patients condition. The radiography part provides the radiologist with guidance during the procedure by creating a visual image of the patients anatomy. This image could be a single image or live imaging which shows the advancement of the wire as it moves. Radiography is also useful because it is used as documentation of the steps completed during the procedure.

(Long, Rollins, & Smith, 2019)

Cryoablation is a procedure performed in IR in conjunction with computed tomography (CT) guidance to treat numerous types of cancer. In the procedure, cold temperatures are used to kill cancer cells while also preventing growth of the cancer.

Cryoablation

- A cryoprobe is inserted into a cancerous tumor under CT guidance to provide real time accuracy of probe insertion
- Argon gas is injected through the probe which freezes the tumor
- Temperatures must be below -40 degrees C to achieve cell death
- The tissue is continuously thawed and refrozen until necrosis occurs
- The frozen tumor is left within the body which releases antigens therefore triggering an immune response
- The antigens could kill future cancer cells and alleviate ones pain or symptoms from the tumor

(Yakkala, Denys, Kandalaf, & Duran, 2020) The image on the left shows two cryoprobes (Ablative Oncology Center, n.d.)

Reason for Procedure

- A primary treatment for numerous types of cancer:
 - Kidney cancer
 - Bone cancer
 - Liver cancer
 - Lung cancer
 - Prostate cancer
 - Cervical cancer
 - Eye cancer
- Relives pain and symptoms caused by the cancer
- Done if patient is not a surgical candidate

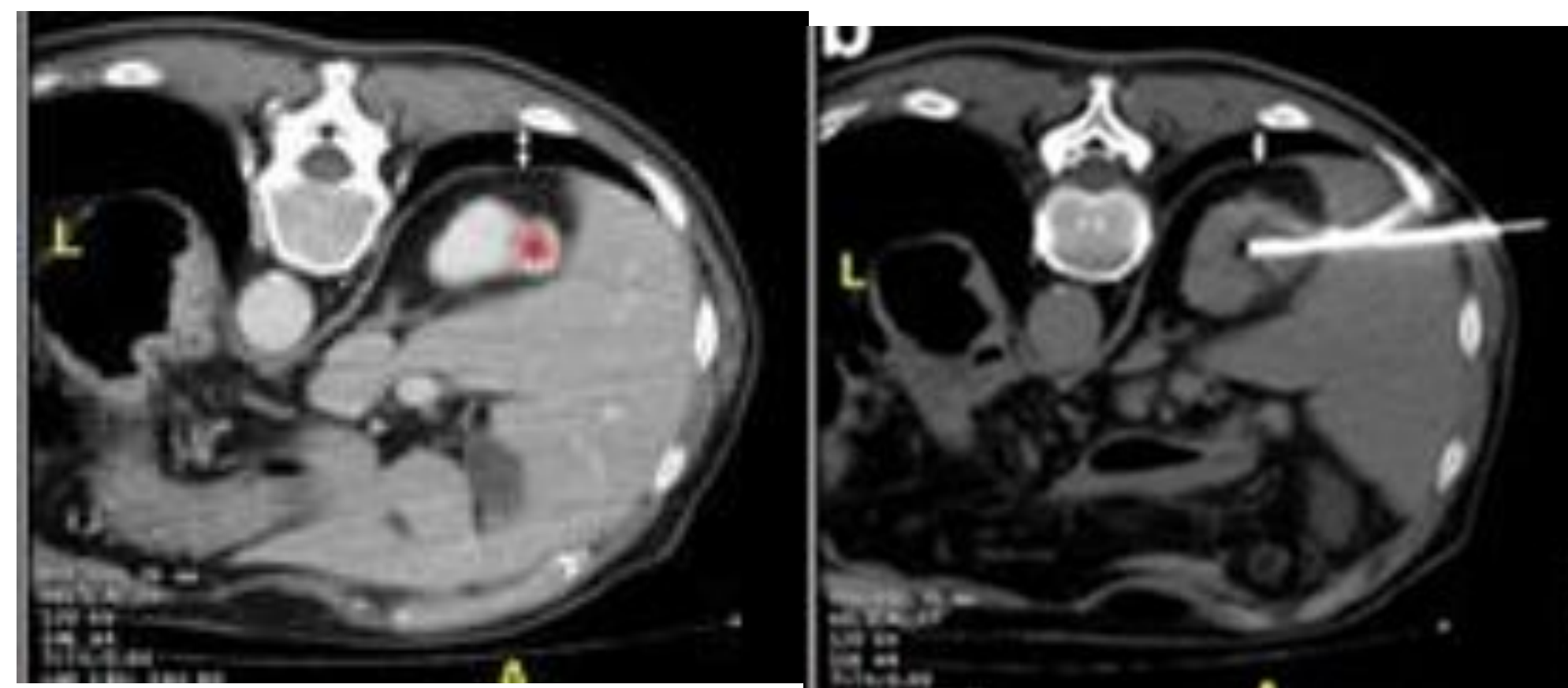
(Mayo Clinic, 2020)

Renal Cell Carcinoma

- Cancerous adenocarcinomas that appear in the renal tubular epithelium
- Usually occurs in patients who are 50-70 years old
- Accounts for 80% of renal tumors (El- Feky, M., 2021)
- Incidence rate increases about 2.4% each year due to incidental diagnosis (Cernic et al., 2021)
- Can occur from smoking, obesity, dialysis related cystic disease, treatment that uses a chemotherapy agent (Cyclophosphamide), hypertension, or after a renal transplant
- Clinical presentation usually consists of blood in the urine, abdominal pain or palpable abdominal mass
- Partial nephrectomy is usually the treatment of choice but cryoablation is done if surgery cannot be performed (El- Feky, M., 2021)

Imaging

- All images were taken from a CT scan of a renal mass in the upper pole of the right kidney



The renal mass is located on the kidney and marked with a red "X"

The cryoprobe is inserted into the renal mass to confirm the correct placement of probe



Image C shows two cryoprobes inserted into the tumor from a sagittal view

(Cernic et al., 2021)

Percutaneous Renal Cryoablation Study

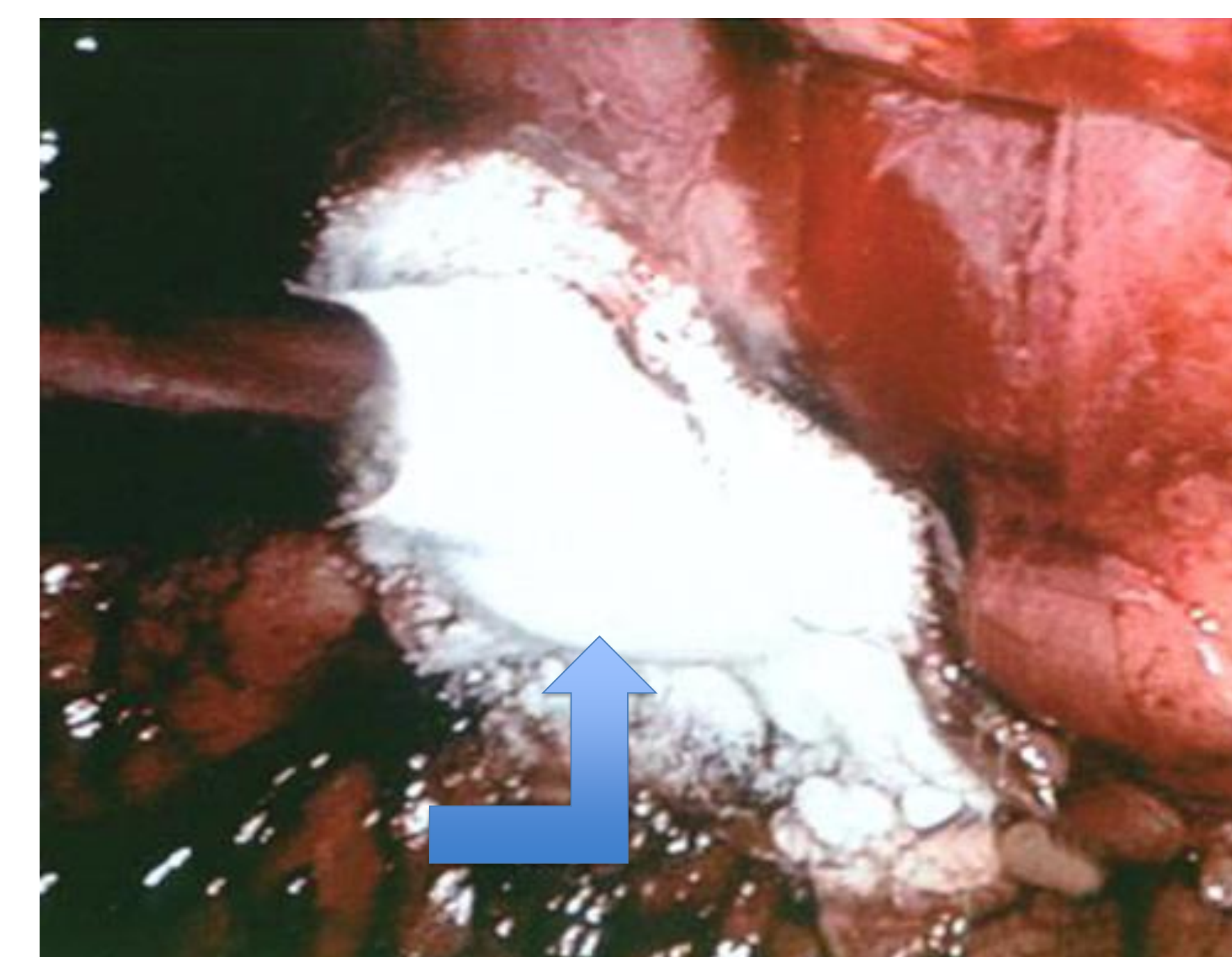
- A qualitative study was conducted by two radiologists to examine the safety and efficacy of cryoablation
- 174 renal tumors were treated by CT guided cryoablations between February of 2011 and June of 2020
- Most of the patients were placed in prone position and adjusted due to anatomy of kidney
- Biopsies were previously performed on all tumors included in the study

(Cernic et al., 2021)

How the Procedure was performed

- 17 Gauge IceSphere or 17 Gauge IceRod cryoprobe were used
- Amount of cryoprobes depended on size of tumor
- One probe is used for every one – two centimeters of tumor
- 10 minute freezing time, then passive 9 minutes, then one minute active thaw: protocol was repeated
- CT imaging was done at 5 and 10 minutes to evaluate ice formation
- If ice did not form around whole tumor, additional cryoprobes were inserted
- Non contrast CT performed after removal of cryoprobes
- Procedural success, effectiveness and complications were evaluated for each procedure

(Cernic et al., 2021)



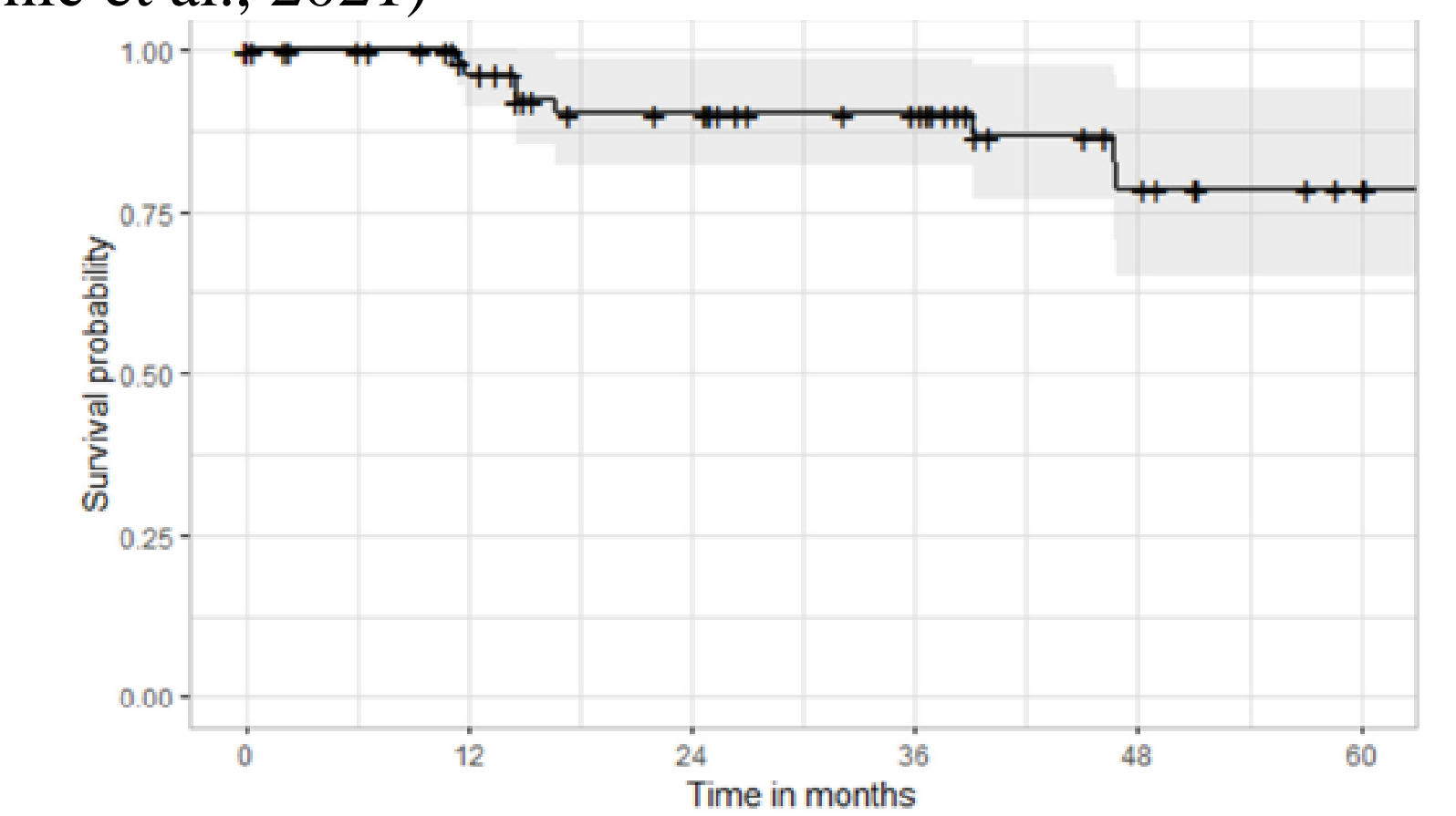
Example of iceball formation on tumor

(Allen & Remer, 2010)

Results of Study

- Procedural success was achieved in 98.3% of tumors (171/174)
- Effectiveness of treatments was 95.3% which then increased to 98.2% after retreats
- Complication rate was 29.8%
- At 1 year after the procedure there was 100% recurrence-free survival
- At 3 years there was 95.3% recurrence-free survival
- At 5 years there was 88.6% recurrence-free survival

(Cernic et al., 2021)



- This graph represents the overall survival rate of patients 60 months following their procedure. The y-axis represents the survival probability and the x-axis represents the time in months
- As the time increased after the procedure, the survival probability slightly decreased but did not reach lower than 75% 60 months post procedure

(Cernic et al., 2021)

Advantages

- Can be used in conjunction with immunotherapies
- Very high accuracy due to ice ball formation which can be depicted on a CT scan
- Shorter recovery time because procedure is not as invasive
- Surrounding tissue is spared
- Used as a vaccination tool by activating immune responses to the tumors cells

(Yakkala et al., 2020)

Conclusion

Cryoablation is a safe and accurate procedure performed in Interventional Radiology to treat cancer for those who are not surgical candidates. This procedure can be performed on numerous types of cancer but renal cell carcinoma has been the main focus of the study. The results from this study conclude that cryoablation can be performed without complications and will remain effective years after it is performed without reoccurrence of the tumor.