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### **Interventional Radiology Treatments for Kidney Cancer**

Kidney cancer is the eighth most common cancer in men and the tenth in women.<sup>1</sup> The most common type of kidney cancer is renal cell carcinoma that forms in the lining of the renal tubules in the kidney that filter the blood and produce urine.<sup>2</sup> Approximately 85 percent of kidney tumors are renal cell carcinomas.<sup>1</sup> When kidney cancer spreads outside the organ, it can often be found in nearby lymph nodes, lungs, bones or liver, as well as the other kidney.<sup>2</sup>

The current gold standard treatment is laparoscopic partial nephrectomy surgery. However, some patients could benefit from minimally invasive, kidney-sparing treatment, such as those with high surgical risk, underlying illnesses, multiple recurrent tumors, borderline kidney function or only one kidney.

Additionally given the recent success of *percutaneous cryoablation*, patients with kidney cancer may elect to avoid surgery and have their tumor treated this way. The urologist and interventional radiologist work together in a multidisciplinary team to determine whether a less invasive percutaneous ablation can be done safely and effectively.

#### **Cryoablation**

Recent interventional cryoablation data are showing near 100 percent efficacy for tumors up to four centimeters if localized to the kidney. Larger localized tumors can also be successfully treated with cryoablation depending on size and location. Ablated lesions show as dead tissue (scar) with no recurrences at one-year follow-up on imaging, after one treatment.<sup>3,5</sup> The one-year benchmark is an established and well-accepted benchmark within the medical community.<sup>3,4,5</sup>

Studies are ongoing to compare cryoablation to partial nephrectomy, and it is expected that the two treatments will be shown to be equivalent in the future. The interventional radiology treatment is less invasive and easier on the patient. This treatment spares the majority of the healthy kidney tissue and can be repeated if needed.

The treatment has an excellent safety profile, and most patients are sent home the same day as the procedure or go home the next day. The most common complication is a bruise (hematoma) around the kidney that goes away by itself.

These interventional treatments also offer valuable benefits to those patients with advanced or metastatic renal cell carcinoma. While not considered curative for these patients, the lesions can be re-treated as needed. Studies are underway on combination treatments. One such study uses cryoablation to kill the primary kidney tumor and immune system stimulation to treat any metastases. Traditional chemotherapy drugs and radiation are generally ineffective for kidney cancer.<sup>6</sup>

Cryoablation is delivered directly into the tumor by a probe that is inserted through the skin using imaging to guide it internally. Cryoablation uses an extremely cold gas to freeze the tumor to kill it. This technique has been used for many years by urologists in the operating room, but in the last few years, the needles have become small enough to be used by interventional radiologists through a small incision in the skin without the need for an operation. The “ice ball” that is created around the needle grows in size and destroys the frozen tumor cells.

## **Radiofrequency Ablation**

For inoperable kidney tumors, radiofrequency ablation (RFA) offers a nonsurgical, localized treatment that kills the tumor cells with heat, while sparing the healthy kidney tissue. This treatment is much easier on the patient and is more effective than systemic therapy. Radiofrequency energy can be given without affecting the patient’s overall health, and most people can resume their usual activities in a few days.

In this procedure, the interventional radiologist guides a small needle through the skin into the tumor. From the tip of the needle, radiofrequency energy is transmitted into the tumor, where it produces heat and kills the tumor cells. The dead tumor tissue shrinks and slowly turns into a scar.

## **Additional Facts About RFA**

- Most effective when the kidney cancer is small in size (five centimeters or less)
- May be performed under conscious sedation or general anesthesia
- Is well tolerated—most patients can resume their normal routines the next day and may feel tired only for a few days
- Can be repeated if necessary
- May be combined with other treatment options

## **Efficacy**

If the tumor is small, RFA can shrink and likely kill the tumor. Although early results are encouraging, long-term follow-up is necessary to determine the precise role of RFA in treating small kidney cancers. Current ongoing studies will determine long-term survival.

Because it is a local treatment that does not harm healthy tissue, the treatment can be repeated as often as needed. It is a very safe procedure, with low complication rates, and it has become more widely available over the last couple of years. The Food and Drug Administration (FDA) has approved RFA for use in soft tissue tumors, of which renal cell carcinoma is one.

## **Risks**

The risks of RFA are similar to a biopsy, namely localized bleeding and some pain. Bleeding that requires action is uncommon partly because the heating from the radiofrequency energy cauterizes the tissue and minimizes the risk of hemorrhage. Heating of the tumor may cause heating of an adjacent structure, which can lead to some healthy tissue damage. This can be avoided by carefully reviewing the size and location of the tumor before the procedure. Tumors adjacent to structures (such as the bowel) may

not be candidates for RFA or may require special procedures (injection of fluid) to create safe distances between the tumor being treated and the adjacent bowel.

## **Cost/Insurance**

Since RFA is new, many insurance companies may require preapproval prior to the procedure.

## **Prevalence and Risk Factors for Kidney Cancer**

More than 32,000 Americans each year are diagnosed with kidney cancer—many of them don't have symptoms.<sup>2</sup> Typically, those with kidney cancer are past the age of 40 and twice as often are men.<sup>2</sup> Other risk factors include

- Smoking
- Obesity
- High blood pressure
- Long-term dialysis
- Von Hippel-Lindau syndrome

## **Symptoms**

The incidence of kidney cancer is on the rise. Fortunately, the availability of modern imaging technology has led to more frequent detection of small, asymptomatic tumors that otherwise would be undetected. Often, small tumors do not cause symptoms and are discovered on CTs, MRIs or ultrasounds that are performed for some other reason, such as standard imaging studies (CT or ultrasound) performed during many emergency room visits. These small tumors are often the best candidates for nonsurgical treatment options.

Common symptoms may include:<sup>2</sup>

- Blood in the urine
- Side pain that does not go away
- A lump or mass in the side of the abdomen
- Weight loss
- Fever
- Feeling very tired

## **Diagnosis**

In addition to a basic physical exam, urine test and blood tests, several other techniques can be used to diagnose kidney cancer. CT scan, MRI or ultrasound can be performed to see inside the body and identify a tumor. An image-guided needle biopsy can be done to remove tissue samples and look for cancer cells. At the time of diagnosis, 25–30 percent of patients have metastases.<sup>1</sup>

## **Management of Advanced Renal Cell Carcinoma**

### **Arterial Embolization**

Advanced renal cell carcinoma tumors are often quite large and invade adjacent structures and veins. They may even extend through the veins into one of the heart chambers. Some patients with advanced tumors may not be surgical candidates. Arterial embolization is an invaluable treatment option for such patients.

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During embolization, an interventional radiologist inserts a small tube (catheter) into an artery in the groin and directs it to the renal artery that supplies blood to the kidney and the tumor. The doctor injects small solid particles or special liquid agents into the artery to block the flow of blood into the kidney. The blockage prevents the tumor from getting oxygen and other substances it needs to grow, causing it to shrink.<sup>2</sup>

In some patients, arterial embolization may shrink the tumor substantially, rendering the patient a suitable surgical candidate. In others, arterial embolization effectively eliminates tumor-related symptoms and improves patients' quality of life.

Arterial embolization has also been used to facilitate surgical resection of large tumors. Blocking the blood supply to the tumor decreases the risk of bleeding and minimizes the amount of blood transfusion during surgery. Similarly, arterial embolization can facilitate ablation of larger tumors. Reduction of blood supply to the tumor renders ablation procedures (RFA or cryoablation) safer and more effective.

## **Surgery**

*Radical nephrectomy:* Kidney cancer may be treated with radical nephrectomy, in which the entire kidney, along with the adrenal gland and some tissue around the kidney, is surgically removed. Some lymph nodes in the area also may be removed.<sup>1</sup>

*Simple nephrectomy:* Some patients with early kidney cancer may have a simple nephrectomy that involves removing only the kidney.<sup>2</sup>

*Partial nephrectomy:* A surgeon removes the section of the kidney with the tumor. This procedure may be used when the patient has only one kidney or the cancer affects both kidneys, and only in patients with small kidney tumors.<sup>2</sup>

## **Biological Therapy and Immunotherapy**

Biological therapy is a systemic therapy that uses substances injected into the bloodstream to reach and affect cells all over the body. Biological therapy utilizes the body's natural ability, such as using the immune system, to fight cancer.<sup>2</sup> Recent advances in immunotherapy have made a significant improvement in survival of patients with inoperable renal cancer.

## **Chemotherapy**

Chemotherapy is a systemic therapy in which anticancer drugs enter the bloodstream and travel throughout the body. Anticancer drugs have shown limited effectiveness against kidney cancer.<sup>2</sup>

## **About Interventional Radiologists**

Interventional radiologists are doctors who specialize in minimally invasive, targeted treatments that have less risk, less pain and less recovery time compared to open surgery. They use their expertise in interpreting X-rays, ultrasound, MRI and other diagnostic imaging studies to understand, visualize and diagnose the full scope of the disease's pathology and to map out the procedure tailored to the individual patient. Then during the

procedure, they image as they go to guide tiny instruments, such as catheters, through blood vessels or skin, to treat diseases at the site of the illness nonsurgically.

Interventional radiology is a recognized medical specialty by the American Board of Medical Specialties. Interventional radiologists complete preliminary training in diagnostic radiology and advanced training in vascular and interventional radiology. The American Board of Radiology certifies their specialized training.

### **For Further Information**

For more information on treatments for kidney cancer or interventional radiology, visit the SIR Web site at [www.SIRweb.org](http://www.SIRweb.org).

### **References**

1. American Foundation for Urologic Disease.
2. National Cancer Institute.
3. Georgiades, C. Johns Hopkins Hospital, Abstract 100, Efficacy of CT-Guided, Percutaneous Cryoablation for Renal Cell Carcinoma: One-Year Follow-up, JVIR, February Supplement, 2008
4. Aoun, H, Littrip, P Wayne State University, Abstract 101, Percutaneous CT-Guided Cryotherapy of Renal Masses: Long-term Follow-up and Morbidity, JVIR, February Supplement 2008. Abstracts can be found at [www.SIRmeeting.org](http://www.SIRmeeting.org).
5. Georgiades C.S., Hong K., Bizzell .C, Geschwind J.-F., Rodriguez R.: Safety and Efficacy of CT-guided Percutaneous Cryoablation for Renal Cell Carcinoma, JVIR 2008; 9: 1302-1310.
6. Kidney Cancer Association.

For an up-to-date list of additional relevant papers on interventional radiology treatments for kidney cancer, visit the SIR Web site at [www.SIRweb.org](http://www.SIRweb.org).