



Radiofrequency Ablation (RFA) / Microwave Ablation (MWA) of Kidney Tumors

Radiofrequency ablation (RFA) and microwave ablation (MWA) are treatments that use image guidance to place a needle through the skin into a kidney tumor. In RFA, high-frequency electrical currents are passed through an electrode in the needle, creating a small region of heat. In MWA, microwaves are created from the needle to create a small region of heat. The heat destroys the kidney cancer cells. RFA and MWA are effective treatment options for patients with one kidney or those who might have difficulty with surgery.



Your doctor will instruct you on how to prepare. Inform your doctor if there's a possibility you are pregnant and discuss any recent illnesses, medical conditions, allergies and medications you're taking. Your doctor may advise you to stop taking aspirin, nonsteroidal anti-inflammatory drugs (NSAIDs) or blood thinners several days prior to your procedure and instruct you not to eat or drink anything for several hours beforehand. Leave jewelry at home and wear loose, comfortable clothing. You may be asked to wear a gown. Plan to have someone drive you home afterward.

What are Radiofrequency and Microwave Ablation of Kidney Tumors?

Radiofrequency ablation, sometimes referred to as RFA, is a minimally invasive treatment for cancer. It is an image-guided technique that uses heat to destroy cancer cells. It uses imaging techniques such as ultrasound, computed tomography (CT) or magnetic resonance imaging (MRI) to help guide a needle electrode into a cancerous tumor. High-frequency electrical currents are then passed through the electrode to ground pads placed on the body, creating focal heat that destroys the cancer cells surrounding the electrode.

Microwave ablation (MWA) is also a minimally-invasive treatment for cancer. MWA also uses ultrasound, computed tomography (CT) or magnetic resonance imaging (MRI) to guide placement of a

specialized needle-like probe into a tumor. MWA uses microwaves to heat and destroy the tumor and is used for the same indications as RFA. The procedure is typically performed on an outpatient basis or with overnight observation in the hospital with general anesthesia. For the patient, MWA offers low risk and a short hospital stay. Ablation can be used to treat multiple tumors simultaneously. The procedure can be repeated if new cancer appears.

What are some common uses of the procedure?

Radiofrequency and microwave ablation are used to treat renal cell carcinoma (kidney tumors).

Ablation is a viable and effective treatment option if you:

- have one kidney.
- have other medical conditions which might prevent surgery.
- are older and might have difficulty with surgery or postsurgical recovery.
- have tumors of less than four centimeters in size.
- have tumors in both kidneys or a familial predisposition (family history) to multiple kidney tumors.
- have a recurrent tumor after surgical resection.

Ablation may also be used pre-operatively to decrease blood loss during surgery.

How should I prepare?

You will likely be instructed not to eat or drink anything after midnight before your procedure. Your doctor will tell you which medications you may take in the morning.

You should report to your doctor all medications that you are taking, including herbal supplements, and if you have any allergies, especially to local anesthetic medications, general anesthesia or to contrast materials containing iodine (sometimes referred to as "dye" or "x-ray dye"). Your physician may advise you to stop taking aspirin, nonsteroidal anti-inflammatory drugs (NSAIDs) or blood thinners for a specified period of time before your procedure.

Prior to your procedure, your blood may be tested to determine how well your kidneys are functioning and whether your blood clots normally.

Women should always inform their physician and x-ray technologist if there is any possibility that they are pregnant. Many imaging tests are not performed during pregnancy so as not to expose the fetus to radiation. If an x-ray is necessary, precautions will be taken to minimize radiation exposure to the baby. See the Safety page for more information about pregnancy and x-rays.

You should plan to have a relative or friend drive you home after your procedure.

You will be given a gown to wear during the procedure.

What does the equipment look like?

In this procedure, computed tomography (CT), needle electrodes, an electrical generator and grounding pads may be used.

Radiofrequency equipment

There are two types of needle electrodes: simple straight needles and a straight, hollow needle that contains several retractable electrodes that extend when needed.

The radiofrequency generator produces electrical currents in the range of radiofrequency waves. It is connected by insulated wires to the needle electrodes and to grounding pads that are placed on the patient's back or thigh.

Microwave equipment

A straight needle is used.

The microwave generator produces electromagnetic waves in the microwave energy spectrum. It is connected by insulated wires to the needles.

Computed Tomography (CT) equipment

The CT scanner is typically a large, box-like machine with a hole, or short tunnel, in the center. You will lie on a narrow examination table that slides into and out of this tunnel. Rotating around you, the x-ray tube and electronic x-ray detectors are located opposite each other in a ring, called a gantry. The computer workstation that processes the imaging information is located in a separate control room, where the technologist operates the scanner and monitors your examination in direct visual contact and usually with the ability to hear and talk to you with the use of a speaker and microphone.

Other equipment that may be used during the procedure includes an intravenous line (IV), ultrasound machine and devices that monitor your heart beat and blood pressure.

How does the procedure work?

Radiofrequency ablation works by passing electrical currents in the range of radiofrequency waves between the needle electrode and the grounding pads placed on the patient's skin. These currents create heat around the electrode, which when directed into the tumor, heats and destroys the cancer cells. At the same time, heat from radiofrequency energy closes small blood vessels and lessens the risk of bleeding. The dead tumor cells are gradually replaced by scar tissue that shrinks over time.

Microwave ablation works by producing electromagnetic waves in the microwave energy spectrum. These microwaves create heat around the needle, which heat and destroy the cancer cells. Heat closes small blood vessels and lessens the risk of bleeding. The dead tumor cells are gradually replaced by scar tissue.

Ultrasound, computed tomography or magnetic resonance imaging may be used to help the physician guide the needle electrode into the tumor.

How is the procedure performed?

Image-guided, minimally invasive procedures such as ablation are most often performed by a specially trained interventional radiologist in an interventional radiology suite or occasionally in the operating room.

Ablation is often done on an outpatient basis.

You will be positioned on the examining table.

You may be connected to monitors that track your heart rate, blood pressure and pulse during the procedure.

A nurse or technologist will insert an intravenous (IV) line into a vein in your hand or arm so that sedation medication can be given intravenously. In some cases, an anesthesiologist may manage your sedation or administer general anesthesia.

Some tumors are located near the part of the kidney that collects urine or to the ureter. In such cases, your urologist may place a temporary stent inserted through your urethra into the ureter. Cool water is slowly dripped through this stent during ablation to protect against heat injury to these structures. The stent is removed usually at the end of the procedure.

The area where the needles are to be inserted will be sterilized and covered with a surgical drape.

Your physician will numb the area with a local anesthetic.

A very small skin incision is made at the site.

If multiple needles are needed, then multiple nicks may be made.

Ablation is performed using one of the following methods:

- Surgery.
- Percutaneous, in which needle electrodes are inserted through the skin and into the site of the tumor.

Using imaging-guidance, your physician will insert the needle electrode through the skin and advance it to the site of the tumor.

Once the needle electrode is in place, energy is applied. For a large tumor, it may be necessary to do multiple ablations by repositioning the needle electrode or by placing multiple needles into different parts of the tumor to ensure no tumor tissue is left behind.

At the end of the procedure, the needle electrode will be removed and pressure will be applied to stop any bleeding and the opening in the skin is covered with a dressing. No sutures are needed.

Each ablation takes about 10 to 30 minutes, with additional time required if multiple ablations are performed. The entire procedure is usually completed within one to three hours.

What will I experience during and after the procedure?

Devices to monitor your heart rate and blood pressure will be attached to your body.

You will feel a slight pin prick when the needle is inserted into your vein for the intravenous line (IV) and when the local anesthetic is injected. Most of the sensation is at the skin incision site, which is numbed using local anesthetic. You may feel pressure when the catheter is inserted into the vein or artery.

If the procedure is done with sedation, the intravenous (IV) sedative will make you feel relaxed, sleepy and comfortable for the procedure. You may or may not remain awake, depending on how deeply you are sedated.

Pain immediately following ablation can be controlled by pain medication given through your IV or by injection. Afterward any mild discomfort you experience can be controlled by oral pain medications. Patients may feel nauseous, but this can also be relieved by medication.

You will remain in the recovery room until you are completely awake and ready to return home.

Your intravenous line will be removed.

You should be able to resume your usual activities within a few days.

Only about ten percent of patients will still have pain a week following ablation.

About one-third of patients may develop fever and flu-like symptoms. This often resolves within 10 days of the procedure.

Who interprets the results and how do I get them?

Computed tomography (CT) or magnetic resonance imaging (MRI) of the kidneys is performed within a few hours to a month following radiofrequency ablation. A radiologist will interpret these CT or MRI scans to detect any complications, to ensure that all of the tumor tissue has been treated and to assess any residual tumor.

Your interventional radiologist may recommend a follow-up visit after your procedure or treatment is complete.

The visit may include a physical check-up, imaging procedure(s) and blood or other lab tests. During your follow-up visit, you may discuss with your doctor any changes or side effects you have experienced since your procedure or treatment.

What are the benefits vs. risks?

Benefits

- Ablation is a relatively quick procedure and recovery is rapid so that chemotherapy may be resumed almost immediately in patients who need it.
- Ablation is less expensive than other treatment options.
- No surgical incision is needed—only a small nick in the skin that does not have to be stitched.
- Unlike surgical treatment, this procedure allows the kidney to be preserved.
- It does not have an effect on blood pressure.
- It may or may not have an effect on renal function depending on how large an area needs to be treated.

Risks

- Severe pain after ablation is uncommon, but may last a few days and require a narcotic for relief.
- Any procedure where the skin is penetrated carries a risk of infection. The chance of infection requiring antibiotic treatment appears to be less than one in 1,000.
- Extension of heat to the part of the kidney that collects urine or to the ureter may rarely result in a urine leak or a narrowing that blocks flow of urine to the bladder. When a tumor is near these areas, your urologist may place a temporary stent inserted through your urethra into the ureter. Cool water is slowly dripped through this stent during ablation to protect against heat injury to these structures.
- There is always a slight chance of cancer from exposure to radiation. However, the benefit of this treatment outweighs the risk.
- Women should always inform their physician and x-ray or CT technologist if there is any possibility that they are pregnant. See the Safety page for more information about pregnancy and x-rays.

What are the limitations of Radiofrequency and Microwave Ablation of Kidney Tumors?

Research indicates that ablation is very effective for small tumors. Complete treatment of a tumor may require more than one session in some cases. Some research suggests that long term tumor control may be better with surgical resection. However, studies examining long-term effectiveness at five or more years are becoming available, demonstrating ablation may be equivalent to surgery in select patients. Because the tumor is destroyed inside the body, CT or MR scans are needed to watch for tumor recurrence over several years.

Disclaimer

This information is copied from the RadiologyInfo Web site (<http://www.radiologyinfo.org>) which is dedicated to providing the highest quality information. To ensure that, each section is reviewed by a physician with expertise in the area presented. All information contained in the Web site is further reviewed by an ACR (American College of Radiology) - RSNA (Radiological Society of North America) committee, comprising physicians with expertise in several radiologic areas.

However, it is not possible to assure that this Web site contains complete, up-to-date information on any particular

subject. Therefore, ACR and RSNA make no representations or warranties about the suitability of this information for use for any particular purpose. All information is provided "as is" without express or implied warranty.

Please visit the RadiologyInfo Web site at <http://www.radiologyinfo.org> to view or download the latest information.

Note: Images may be shown for illustrative purposes. Do not attempt to draw conclusions or make diagnoses by comparing these images to other medical images, particularly your own. Only qualified physicians should interpret images; the radiologist is the physician expert trained in medical imaging.

Copyright

This material is copyrighted by either the Radiological Society of North America (RSNA), 820 Jorie Boulevard, Oak Brook, IL 60523-2251 or the American College of Radiology (ACR), 1891 Preston White Drive, Reston, VA 20191-4397. Commercial reproduction or multiple distribution by any traditional or electronically based reproduction/publication method is prohibited.

Copyright © 2019 Radiological Society of North America, Inc.