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 (RFA) is a minimally invasive treatment for cancer. It is an image-guided technique that uses heat to destroy cancer cells. RFA uses ultrasound, computed tomography (CT), or magnetic resonance imaging (MRI) to help guide a needle electrode into a cancerous tumor. RFA passes high-frequency electrical currents through the electrode to ground pads placed on the body. This creates focused heat that destroys the cancer cells surrounding the electrode.

Microwave ablation (MWA) is a minimally-invasive treatment for cancer. MWA uses ultrasound, computed tomography (CT), or magnetic resonance imaging (MRI) to guide placement of a needle-like probe into a tumor. MWA uses microwaves to heat and destroy the tumor. Doctors use MWA for the same indications as RFA. The doctor will typically perform the procedure on an outpatient basis. Or, you may receive general anesthesia and stay in the hospital overnight while you recover. MWA offers low risk and a short hospital stay. It can treat multiple tumors simultaneously. Your doctor can repeat the procedure 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?

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

Tell your doctor about all the medications you take, including herbal supplements. List any allergies, especially to local anesthetic, general anesthesia, or contrast materials. Your doctor may tell you to stop taking aspirin, nonsteroidal anti-inflammatory drugs (NSAIDs) or blood thinners before your procedure.

Prior to your procedure, your doctor may test your blood to check your kidney function and to determine if your blood clots normally.

Women should always tell their doctor and technologist if they are pregnant. Doctors will not perform many tests during pregnancy to avoid exposing the fetus to radiation. If an x-ray is necessary, the doctor will take precautions to minimize radiation exposure to the baby. *See the Safety in X-ray, Interventional Radiology and Nuclear Medicine Procedures page (https://www.radiologyinfo.org/en/info/safety-radiation) for more information about pregnancy and x-rays.*

Plan to have someone drive you home after your procedure.

The nurse will give you 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

- No surgical incision is necessary—only a small nick in the skin that does not need stitches.

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, donut-shaped machine with a short tunnel in the center. You will lie on a narrow table that slides in and out of this short 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 in a separate control room. This is where the technologist operates the scanner and monitors your exam in direct visual contact. The technologist will be able to hear and talk to you using a speaker and microphone.

This procedure may use other equipment, including 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. The heat is directed into the tumor where it 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 heats and destroys the cancer cells. Heat closes small blood vessels and lessens the risk of bleeding. The dead tumor cells are gradually replaced by scar tissue.

The doctor may use ultrasound, computed tomography, or magnetic resonance imaging to help 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 lie on the procedure table.

The doctor or nurse may connect you to monitors that track your heart rate, blood pressure, oxygen level, and pulse.

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 doctor will sterilize and cover the area where the needles will be inserted with a sterile drape.

Your doctor will numb the area with a local anesthetic. This may briefly burn or sting before the area becomes numb.

The doctor will make a very small skin incision 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 the doctor inserts needle electrodes through the skin and into the site of the tumor.

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

Once the needle electrode is in place, radiofrequency 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 doctor will remove the needle electrode and apply pressure to stop any bleeding. They will cover the opening in the skin 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

usually takes one to three hours.

What will I experience during and after the procedure?

The doctor or nurse will attach devices to your body to monitor your heart rate and blood pressure.

You will feel a slight pinch when the nurse inserts the needle into your vein for the IV line and when they inject the local anesthetic. Most of the sensation is at the skin incision site. The doctor will numb this area using local anesthetic. You may feel pressure when the doctor inserts the catheter into the vein or artery. However, you will not feel serious discomfort.

If the procedure uses sedation, you will feel relaxed, sleepy, and comfortable. You may or may not remain awake, depending on how deeply you are sedated.

Your doctor can control your pain immediately following ablation with medication via IV or by injection. Afterward, oral pain medication can control any mild discomfort. You may feel nauseous. Medication can ease this as well.

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

The doctor or nurse will remove your IV line before you go home.

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.

This visit may include a physical check-up, imaging exam(s), and blood tests. During your follow-up visit, tell your doctor if you have noticed any side effects or changes.

What are the benefits vs. risks?

Benefits

- Ablation is a relatively quick procedure and recovery is rapid. Chemotherapy may resume almost immediately in patients who need it.
- Ablation is less expensive than other treatment options.
- No surgical incision is necessary—only a small nick in the skin that does not need stitches.
- 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. It may last a few days and require medication for relief.

- Any procedure that penetrates the skin 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 tell their doctor and x-ray or CT technologist if there is any chance they are pregnant. *See the Safety in X-ray, Interventional Radiology and Nuclear Medicine Procedures (https://www.radiologyinfo.org/en/info/safety-radiation) 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.

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