Thermal Ablation for Tumor Treatment



Thermal ablation is a minimally invasive, image-guided treatment that uses heat or extreme cold to destroy tumor cells, including cancer. Doctors sometimes use ablation to treat benign tumors. This article focuses on ablation for cancerous tumors.

Your doctor will instruct you on how to prepare. Tell 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 to fast for several hours beforehand. Leave jewelry at home and wear loose, comfortable clothing. You may need to change into a gown. Plan to have someone drive you home afterward.

What is Thermal Ablation for Tumor Treatment?

Thermal ablation is a minimally invasive, image-guided treatment that uses heat or extreme cold to destroy tumor cells, including cancer. Doctors sometimes use ablation to treat benign tumors. This article focuses on ablation for cancerous tumors of the lung, liver, and kidney using cryoablation (sometimes called Cryotherapy), radiofrequency ablation (RFA), and microwave ablation (MWA). Doctors sometimes use cryoablation to treat bone and breast tumors.

While the ablation technique may vary between specific tumor types, the general approach for each procedure is largely the same. Thermal ablation uses ultrasound, computed tomography (CT), or magnetic resonance imaging (MRI) to help guide a needle probe into a cancerous tumor.

RFA and MWA use heat to destroy cancer cells. Cryoablation uses extreme cold to freeze and destroy tumors. Your doctor can discuss the differences between ablation types specific to your diagnosis. For many tumor types, there are no known differences between using heat- and cold-based treatments.

What are some common uses of the procedure?

Thermal ablation is a viable and effective treatment option if you:

- are not a candidate for surgery due to other existing conditions.
- have multiple tumors in your lungs, bones, or liver that have spread from a cancer elsewhere in your body, such as the kidney, intestine, or breast (metastases (http://www.radiologyinfo.org)). Your doctor can treat more than one lesion at the same time.

Your doctor can also use ablation with chemotherapy to treat one or more metastases that are growing in spite of chemotherapy. Your doctor can also use ablation to relieve pain when a tumor invades the chest wall or bone and to reduce the size of a tumor so that chemotherapy (http://www.radiologyinfo.org) or radiation therapy (http://www.radiologyinfo.org) are more effective.

Ablation can be a complementary technique for treating lung tumors. Doctors may use it with surgery, radiation therapy, and/or chemotherapy. Ablation alone can treat small tumors, or the doctor may combine it with other therapies to relieve pain. Ask your

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doctor if thermal ablation is an effective treatment option for you.

How should I prepare for the procedure?

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

You should always tell the doctor and technologist (http://www.radiologyinfo.org) if you are pregnant. Doctors will not perform many tests during pregnancy to avoid exposing the fetus (http://www.radiologyinfo.org) to radiation. If an x-ray is necessary, the doctor will take precautions to minimize radiation exposure to the baby. See the Radiation Safety (https://www.radiologyinfo.org/en/info/safety-radiation) page for more information about pregnancy and x-rays.

Your doctor will likely tell you to fast after midnight before your procedure. They will tell you which medications you may take in the morning. You will need to change into a gown for the procedure.

Some doctors recommend a short, overnight hospital stay after cryoablation of deep tumors. If the procedure uses a large, surgical incision (cryosurgery), you will need a short hospital stay. Doctors can perform percutaneous (http://www.radiologyinfo.org) cryoablation on an outpatient basis, but you may need to stay overnight for observation. Plan to have someone drive you home after your procedure.

What does the equipment look like?

Thermal ablation may use CT, ultrasound, or MRI equipment to guide the doctor in placing the ablation probes. Whether using RFA, MWA, or cryoablation, the systems consist of needle-like structures (sometimes called probes or antennae) connected via cords to a generator. Certain ablation systems have tanks of gas associated with them to help produce heat or cold.

Your procedure may use other equipment, including an intravenous line (IV), ultrasound machine, and devices that monitor your heartbeat and blood pressure.

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.

Ultrasound equipment

Ultrasound machines consist of a computer console, video monitor and an attached transducer. The transducer is a small hand-held device that resembles a microphone. Some exams may use different transducers (with different capabilities) during a single exam. The transducer sends out inaudible, high-frequency sound waves into the body and listens for the returning echoes. The same principles apply to sonar used by boats and submarines.

The technologist applies a small amount of gel to the area under examination and places the transducer there. The gel allows sound waves to travel back and forth between the transducer and the area under examination. The ultrasound image is immediately visible on a video monitor. The computer creates the image based on the loudness (amplitude), pitch (frequency), and time it takes

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for the ultrasound signal to return to the transducer. It also considers what type of body structure and/or tissue the sound is traveling through.

Magnetic resonance imaging equipment

The traditional MRI unit is a large cylinder-shaped tube surrounded by a circular magnet. You will lie on a table that slides into a tunnel towards the center of the magnet.

Short-bore MRI units have magnets that do not completely surround you. Newer MRI machines have a larger diameter bore, which can be more comfortable for larger patients or those with claustrophobia. “Open” MRI units are open on the sides. These are especially helpful for examining larger patients or those with claustrophobia. Open MRI units can provide high quality images for many types of exams; Open MRI may not be used for certain exams. For more information, consult your radiologist.

How does the procedure work?

The doctor will use ultrasound, CT, or MRI to help guide the probe into the tumor. RFA uses electrical currents in the range of radiofrequency waves. Microwave ablation uses electromagnetic waves in the microwave energy spectrum. Energy sent through the probe creates heat at its tip. This heat destroys cancer cells and closes small blood vessels, which reduces the risk of bleeding. The dead tumor cells are gradually replaced by scar tissue that shrinks over time.

Cryoablation uses extremely cold temperatures to destroy tissue, including cancer cells. Using image-guidance, the doctor inserts a thin, wand-like needle called a cryoprobe through the skin and directly into tissue. They may use one or more cryoprobes. Argon or nitrogen gas flows through a tube into the cryoprobe, which brings the temperature at the tumor down to very low levels. These very cold temperatures freeze and destroy the tumor.

How is the procedure performed?

A specially trained interventional radiologist (http://www.radiologyinfo.org) will most often perform image-guided, minimally invasive procedures such as ablation in an interventional radiology (http://www.radiologyinfo.org) suite or occasionally in the operating room. Doctors can perform thermal ablation on an outpatient basis. After some ablation procedures, however, you may need to stay in the hospital overnight for observation.

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 (http://www.radiologyinfo.org) will insert an intravenous (http://www.radiologyinfo.org) (IV) line into a vein in your hand or arm to administer a sedative.

Your doctor will use medical imaging to precisely locate the tumor. The doctor will sterilize and cover this area with a sterile drape and numb it with a local anesthetic (http://www.radiologyinfo.org) . This may briefly burn or sting before the area becomes numb.

Your doctor may use intravenous conscious sedation and/or general anesthesia in addition to local anesthetic. They will determine the most appropriate type of anesthesia to use during the initial evaluation.

Using imaging-guidance, your doctor will insert the needle through the skin and advance it to the site of the tumor. Once in place, the doctor will activate the probe, freezing or burning the area to kill the tumor cells. A large tumor may require the doctor to do multiple ablations by repositioning the needle electrode or by placing multiple needles into different parts of the tumor. This will help ensure no tumor tissue remains.

Each ablation takes about 10 to 30 minutes, with additional time required if the doctor performs multiple ablations. The entire procedure usually takes one to three hours. 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. The doctor or nurse

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will remove your IV line before you go home.

What will I experience during and after the procedure?

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

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 ablation probe. 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. Some patients may require general anesthesia, thus being asleep during the entire procedure. Talk with your doctor about which option is best for you.

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 should be able to resume your usual activities within one to seven days. You should avoid lifting heavy objects for at least 72 hours.

Only about ten percent of patients will still have pain a week following an ablation. About one-third of patients may develop fever and flu-like symptoms within days after the ablation. This is the body's reaction to the ablation. It often resolves within 10 days of the procedure.

Who interprets the results and how do I get them?

The interventional radiologist or doctor treating you will determine the results of the procedure. They will send a signed report to your referring physician, who will share the results with you.

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 of Thermal Ablation?

Benefits

- Thermal ablation is a relatively quick procedure and recovery is rapid. Chemotherapy may resume almost immediately in patients who need it. Recovery time for cryosurgery may be less than for open surgery.
- Thermal ablation is less expensive than other treatment options.
- You may be released several hours after the procedure, or you may stay overnight. Overnight stays for pain control are usually unnecessary.
- Because the doctor only uses a small incision to pass the probe through the skin, damage to healthy tissue is minimal.

Risks

- 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. Also, some bleeding may result.
- While your doctor takes care to avoid damage to surrounding tissue using imaging guidance, damage to normal structures may occur. Depending on the site of treatment, ablation may result in pain, organ inflammation, abscess, or infection.
- Complications related to procedure medications, including anesthesia, may occur.
- This procedure may involve exposure to x-rays. However, radiation risk is not a major concern when compared to the benefits of the procedure. Always tell your doctor and x-ray technologist if you are pregnant. *See the Radiation Safety (https://www.radiologyinfo.org/en/info/safety-radiation) page for more information about pregnancy and x-rays*

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and the Radiation Dose (https://www.radiologyinfo.org/en/info/safety-xray) *page for information about radiation risk.*

- About one in four patients may develop a "post-ablation syndrome" with flu-like symptoms that appear three to five days after the procedure and usually last about five days. An occasional patient may remain ill for two to three weeks. You can manage fever and other symptoms with oral acetaminophen (http://www.radiologyinfo.org) or ibuprofen.

What are the limitations of Thermal Ablation?

There is a limit to the amount of tumor tissue that thermal ablation can destroy. This is due to limitations with current equipment. Technical advances will permit treatment of larger tumors in the future. Microscopic tumors that medical imaging cannot see cannot be ablated. Tumors smaller than 2 to 3 mm (1/10 inch) in size are often not seen with current imaging technology.

Ablation is a localized (http://www.radiologyinfo.org) therapy. It can only treat disease at a single site. It cannot always treat cancer that has spread to other parts of the body. Because doctors are only able to treat the tumors they see on radiologic images, microscopic cancer cannot be treated.

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