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## RadioFrequency Ablation

### What is RFA?

Radiofrequency ablation (or “RFA”) is a non-surgical treatment for thyroid nodules. It uses an electrode that resembles a needle to direct focused heat energy which ablates (or destroys) the thyroid nodule. This leads to a long-term significant decrease in the size of the nodule, usually in the range of 50-90% of the original nodule volume. These therapies are best used to alleviate symptoms associated with large thyroid nodules and can be an effective non-surgical alternative to help patients avoid thyroid surgery, permanent scarring, and the need for lifelong thyroid medications.

### The basic RFA technique

While treatment methods can vary, the procedure is typically performed with the patient lying on their back, with the neck slightly extended (chin up to the sky). The neck area is cleaned and numbed, and sterile drapes or towels are placed to keep the area clean. An RFA needle is inserted through the skin and is guided into the thyroid nodule using ultrasound imaging. An electric current is used to generate a precisely focused amount of heat at the tip of the needle which is moved throughout the nodule. Once all the key areas of a nodule have been ablated, patients can go home shortly after the procedure and the nodule (or nodules) will slowly shrink over time.

### Indications

RFA is most often used as an alternative to surgery to treat one or sometimes several benign thyroid nodules. Though surgery remains the gold standard for the treatment of symptomatic benign thyroid nodules, RFA is increasingly being used by experts in minimally invasive thyroid treatments as a first-line option. RFA can also be safely used to treat overactive or “toxic” autonomous thyroid nodules. These are nodules that produce too much thyroid hormone and cause hyperthyroidism. In select situations,

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RFA is being increasingly used to treat small thyroid cancers, however, this is still being studied and is not yet widely offered in all locations.

## **Contraindications:**

### **What might prevent RFA?**

Because radiofrequency ablation (RFA) is a procedure that can be done without general anesthesia, it is safe for most patients—even those who have multiple medical problems. It is important to let your doctor know when you are taking medications like blood thinners or aspirin. These may increase your risk of bleeding and bruising (or hematoma) associated with the procedure, and they will need to be temporarily stopped before your treatment. It is also important to tell your doctor about any medical implants in your body, such as a pacemaker or a defibrillator. These devices can detect the energy from the RFA, which might make them malfunction. While having such a device is not an absolute contraindication, it needs to be considered and managed. Any jewelry that is metal and not removable should also be noted. You should also discuss with your doctor if you have had any difficulty tolerating prior medical procedures, such as your FNA thyroid biopsy. If you are pregnant, RFA—just like surgery and other invasive procedures -- will usually be delayed until after your pregnancy is delivered. However, in circumstances when more urgent treatment is needed, RFA can be done with special ‘bipolar’ electrodes during pregnancy. There are no absolute contraindications, meaning anyone is potentially a candidate for RFA, but some factors might make RFA more difficult or a less optimal treatment.

## **How effective is RFA?**

### **Benign nodules**

RFA is considered an effective first-line treatment for benign thyroid nodules that are large, actively growing, cause changes in neck shape, or cause compression symptoms. Nodules treated with RFA typically shrink in volume

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by 50-90% in the first 6-12 months after treatment, and much of the size change occurs in the first two months following therapy. Although a treated nodule does not typically disappear completely, a sufficient size reduction is enough to make symptoms go away and restore a normal neck contour, which are the goals of RFA treatment. Treatment effectiveness is highly dependent on the skill of your treating physician so it is important to ask your doctor about their experience and outcomes with RFA.

### **Toxic nodules**

Toxic, also known as “hot” or autonomously functioning thyroid nodules produce too much thyroid hormone and cause hyperthyroidism. These nodules have been traditionally treated with either radioactive iodine (RAI) or surgery, but can also often be treated with radiofrequency ablation (RFA). Prior studies show that normal thyroid function will be restored in about 50-80% of people after RFA and medications used to control hyperthyroidism before treatment can be stopped. Since RFA is slightly less effective than RAI or surgery in resolving hyperthyroidism, it is important to discuss all potential treatment options with your doctor to determine the best option that suits your goals.

### **Thyroid cancer**

There is currently not enough evidence to support the widespread use of RFA for primary thyroid cancer treatment. However, several smaller studies suggest it can be quite effective. Tumors treatable by RFA are typically smaller cancers surrounded by normal thyroid tissue, without evidence that the cancer has spread to the lymph nodes in the neck. Outcomes are highly dependent on the size of the cancer, its location in the thyroid, and the experience of the treating physician. It is therefore important to discuss all these issues with your doctor if you consider RFA for the treatment of your thyroid cancer.

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## **Lymph nodes**

Surgery remains the gold standard for completely removing cancerous lymph nodes that recur or persist after initial therapy with thyroidectomy and RAI. However, RFA may be a good non-surgical alternative in select cases. The best candidates for RFA treatment are patients with 1 or very few cancerous lymph nodes, favorably located in an area of the neck that can be easily accessed during the procedure. RFA only treats lymph nodes that are visible at the time of treatment, and some studies show that a small number of treated patients will develop recurrent cancer in lymph nodes nearby or elsewhere in the neck. On the other hand, surgery allows the removal of all lymph nodes in an affected area of the neck and may reduce the risk of future lymph node recurrence. The primary advantage of RFA like all minimally invasive procedures is that general anesthesia and an open incision can be avoided. For patients with multiple medical problems that make the use of general anesthesia unappealing, have cancer recurrence despite multiple prior surgeries, or simply wish to avoid surgery when possible, RFA remains a reasonable option that you should discuss with your doctor.

## **How is RFA performed?**

### **Technique**

RFA is performed using a long, thin, stiff electrode roughly the same thickness as the needle used when you donate blood. It is a sterile procedure, meaning that all instruments and the surface of your neck are cleared of bacteria. The electrode is guided to its target (the nodule, lymph node, or cancer) using ultrasound. The electrode delivers radiofrequency energy and produces a small area of heat, which kills the cells in the targeted tissue. Because the heated area is small, the electrode is moved slowly

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through the target to deliver a complete treatment. This is all done using ultrasound guidance, to avoid injuring any tissue outside of the target area.

### **Awake vs General anesthesia**

General anesthesia to put you to sleep is normally required during surgery but is not recommended for ablative procedures like RFA. Although a small dose of a medication like Xanax or Ativan to help you relax may be used, it is most common, and likely most safe to have RFA done while you are relaxed and awake. This allows you to speak, breathe, and swallow normally during the procedure. Pain is usually well controlled through the use of local anesthetic injected into the skin and around the thyroid. Since you're awake during the procedure, if you experience any significant discomfort, you can let your doctor know so more anesthetic can be used or the treatment settings changed as needed to keep you comfortable.

### **Duration of procedure**

Typically, the RFA procedure will take 30-60 minutes, with about 10-30 minutes dedicated to setup time and 20-50 minutes dedicated to the treatment. Larger nodules may require more time for a thorough ablation. You will likely then be observed for some time following the procedure to make sure you are recovering appropriately before discharge. Your doctor will typically let you know how long you should expect to stay once the procedure is completed, and how long the actual procedure will take.

### **Local and regional analgesia**

The thyroid capsule which is the membrane that surrounds the gland contains all of the thyroid's pain-sensing nerves. Before starting the treatment the thyroid capsule, surrounding muscles, and soft tissues—which also have pain-sensing nerves, will be numbed with a local anesthetic such as lidocaine or bupivacaine. This local numbing is usually all that is required to keep you comfortable during the procedure. Some doctors also employ a “regional block” directly targeting large sensory nerves in the neck.

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When RFA is done with local anesthetic you remain awake, and able to talk, swallow, and breathe normally. You'll also be able to communicate with your doctor during the procedure about any pain or discomfort you might be feeling. If you do report discomfort, the energy delivered by the electrode can be reduced and additional numbing medication can be applied if needed.

## **Where is RFA performed?**

### **Outpatient clinic**

The most common setting for thyroid radiofrequency ablation (RFA) is in an outpatient clinic in a procedure room that is specially designed for outpatient procedures like RFA. This room will include an examination table, ultrasound, and sterile instruments. After the procedure is complete, you will usually be observed in a recovery area for anywhere from 30-90 minutes and will then be discharged home.

### **Ambulatory surgery center**

Some specialists perform thyroid RFA at an outpatient surgical facility. These may be stand-alone or affiliated with a nearby hospital. At these centers, your procedure will be performed in an operating room, with a standard surgical table, instruments, and ultrasound. Though outpatient surgical facilities have anesthesiology support and can provide twilight sedation or general anesthesia, these are rarely necessary for RFA. Even if your RFA is performed in an ambulatory surgery center, unless deeper anesthesia is required, you will remain awake, and able to talk, swallow and breathe normally. After the procedure is complete, you will usually be observed in a recovery area for anywhere from 30-90 minutes before you are discharged home.

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Some outpatient surgical centers require facility fees in addition to the costs directly related to the RFA procedure. These facility fees cover the equipment, medications, and staffing for the hospital. Most insurance companies will cover a large portion—if not all—of the facility fee costs, but it is important to discuss this with both your insurance provider and your thyroid specialist.

### **Hospital operating room**

In some cases, RFA will be performed in a traditional hospital operating room. This may be more likely if you have certain medical conditions that require intensive monitoring, or if you require sedation or general anesthesia. In these cases, the procedure is performed in a sterile area, with overhead lights, and a standard operating room table. After the procedure, you will go to a post-operative recovery area where a nurse may monitor you for 30-90 minutes, or longer if you have other medical conditions that require a longer observation period.

Most hospitals will charge facility fees in addition to the costs directly related to the RFA procedure. These facility fees cover the equipment, medications, and staffing for the hospital. Most insurance companies will cover a large portion—if not all— of the facility fee costs, but it is important to discuss this with both your insurance provider and your thyroid specialist.

### **Interventional radiology**

If your thyroid specialist is an interventional radiologist, your RFA will likely be performed in an interventional radiology suite in a room specially designed for radiology-guided procedures. These procedure rooms include an examination table, sterile instruments, and ultrasound. Some interventional radiology suites have sedation available. Even if your RFA is performed in an interventional radiology suite, you will likely remain awake, and able to talk, swallow and breathe normally. After the procedure is complete, you will

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usually be observed in a recovery area for anywhere from 30-90 minutes before discharge home.

Most interventional radiology suites are located within a hospital and will charge facility fees in addition to the costs directly related to the RFA procedure. These facility fees cover the equipment, medications, and staffing for the hospital. Most insurance companies will cover a large portion—if not all— of the facility fee costs, but it is important to discuss this with both your insurance provider and your thyroid specialist.

## **What is the recovery like following RFA?**

### **Observation period**

Recovery after RFA is usually very fast. At most facilities, at the end of the procedure, you will be observed for 30-90 minutes in a recovery area before discharge. During this time, your doctor or nurse will be monitoring you for any signs of bleeding or voice change. These complications are extremely rare, and most patients may go home after observation. If sedation was used during your procedure, a family member will need to take you home. Taking it easy away from work for a day or two during your initial recovery is usually recommended, and you'll also be told to do no lifting of over 20 lbs for the first week or so once you're home. Post-procedure pain and discomfort are usually mild to moderate and easily managed. Bruising associated with the procedure is not usually extensive and generally heals quickly without specific treatment. You will generally feel able to return to light duty like a desk job or remote work from home within a day or two. If you have a more physical job—especially one that requires heavy lifting, discuss your return to work with your treating physician.



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### **Pain control**

After your RFA procedure, you may feel soreness in the treatment area which usually responds to acetaminophen (Tylenol) or ibuprofen (Advil/Motrin). Stronger pain medications are always available but are not usually necessary. For most patients, using a cold compress for the first day or so after treatment will also help with soreness. Usually, any post-procedure discomfort improves significantly over the first few days after treatment.

### **Steroids**

Swelling after RFA can occur and can be more pronounced in nodules over 4cm in size. In some cases, your doctor may recommend a short course of an oral steroid medication such as prednisone. If prescribed, the treatment usually lasts no more than 3-7 days and involves a gradual taper to lower doses. When taken for a short period such as this, oral steroids are very safe and have little or no long-term effects.

### **Follow-up schedule**

After RFA, the treated nodules should significantly shrink over a 6- to 12-month period. Most of the shrinkage—and symptom improvement—occurs over the first 1-3 months. A typical follow-up schedule involves a visit to your thyroid specialist 1 month after RFA, and a neck ultrasound at 3, 6, and 12 months after the procedure. Practices vary, however, and your specialist may recommend more or less frequent visits. These exams will help measure how much your thyroid nodule(s) have responded to the procedure and help determine whether further treatment is required. Your thyroid hormone levels will also be checked to ensure thyroid function remains normal after RFA.

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## **Risks associated with RFA**

### **Nodule rupture**

Though the exact mechanism remains unknown, following RFA a treated nodule may leak—or rupture. This allows the liquified contents of the nodule to leak into the tissue surrounding the thyroid. This complication is extremely rare and occurs in approximately 1 out of 100. When nodule rupture occurs, most cases are managed non-surgically with close observation. Antibiotics may also be prescribed to prevent infection which could require drainage, or even surgery to remove the infection and treat part of the thyroid.

### **Bleeding**

A limited amount of bruising around the RFA treatment site is not unusual but more severe bleeding that leads to a large collection of blood called a hematoma is not at all common. Larger bruises may be sore and tender but a serious hematoma that causes compressive symptoms such as difficulty breathing or swallowing occurs in fewer than 1% of patients. The risk of hematoma following thyroid surgery is 1-2%, but unlike hematomas associated with RFA, most surgical hematomas require a second urgent surgery.

After RFA, if a hematoma occurs, as long as it does not significantly impair breathing or swallowing it can usually be managed non-surgically with observation and pain medications if needed. Nevertheless, if you experience signs of compression or swelling after RFA that cause difficulty swallowing or breathing, notify your treating physician and seek emergency care in a local emergency department immediately if necessary.

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## **Voice injury**

There are nerves behind each lobe of the thyroid that control the muscles that move your vocal cords. Injury to one of these nerves during RFA can cause temporary or even permanent changes in the voice. This complication is very rare: temporary voice change is reported in about 1% of treated patients, while permanent voice change occurs in roughly 1 out of 500 patients. To put this in context, thyroid surgery carries a roughly 5% risk of temporary voice change and a 1% risk of permanent voice injury. For patients undergoing RFA without sedation, patients are awake and able to speak during the procedure so the voice can be monitored for any signs of injury. The ability to detect voice change immediately is one of the main advantages of undergoing RFA without sedation. If voice change is noticed during RFA, it's usually necessary to abandon the treatment. However, in the rare event that a voice change occurs, your specialist may be able to perform a rescue procedure by injecting cold fluids around to cool the injured nerve. This may result in full recovery more efficiently than if the rescue procedure is not performed.

## **Hypothyroidism**

Removing a thyroid nodule surgically, usually involves removing half of the thyroid in a procedure called a lobectomy. Lobectomy causes hypothyroidism requiring thyroid hormone replacement in 20-30% of treated patients. However, the risk of hypothyroidism after a minimally invasive procedure like RFA is far less than 1%. Preserving normal thyroid function is one of the main advantages of minimally invasive thyroid treatments such as RFA over thyroid surgery.