Radioactive iodine (I-131) Therapy for Thyroid Cancer

Radioactive iodine (RAI) is a therapy used in the treatment of some thyroid cancers, specifically papillary and follicular thyroid cancer. For the thyroid gland to make thyroid hormone, the first step in the process is for the thyroid cells to "take up" iodide from the bloodstream. Iodide is one of the building blocks used to produce thyroid hormone. By making the iodine radioactive (in the form of I-131), it becomes toxic to cells that accumulate iodine from the bloodstream, in turn killing these cells. This therapy can be used for several purposes:

- The most common use of RAI is to destroy (called "ablate") the small amount of normal thyroid that remains (called the "remnant") after you have had thyroid surgery (near-total or total thyroidectomy). This use of RAI is called remnant ablation.
- Sometimes, but not always, thyroid cancer cells are also able to "take up" iodine, which means that the cancer cells are "iodine-avid". If there are any remaining thyroid cancer cells after surgery or if thyroid cancer returns AND if the cells have this ability to concentrate iodine, then the RAI may kill these cells and act as a treatment.
- RAI treatment includes a follow up scan, known as a "post-therapy scan" performed 7-10 days after treatment, which can also allow your treatment team to see that the RAI targeted the thyroid "remnant" and to detect if there are any remaining cancer cells that "took up" the I-131 but were not visible on other scans.
- RAI treatment can also be repeated for persistent, recurrent, or metastatic thyroid cancer (cancer that has spread outside the thyroid gland, to lymph nodes or other areas of the body).

Given the potential benefits of RAI, it may seem like something all patients with thyroid cancer should receive. However, RAI does have potential side effects to consider. In addition, patients with larger, more aggressive or residual tumor after surgery have been shown to derive a survival benefit with RAI, but those with smaller, less aggressive cancers have not.

Remnant Ablation

RAI for remnant ablation destroys any residual normal thyroid tissue, allowing your physicians to more easily detect if your thyroid cancer comes back. A blood test called thyroglobulin is used in surveillance monitoring of thyroid cancer. Thyroglobulin is a protein that is only produced by either normal thyroid cells or thyroid cancer cells. After surgery you may still have a small amount of normal thyroid cells remaining (thyroid remnant) in your neck. This is because it is difficult to safely remove the entire thyroid without damaging nearby structures, such as the vocal cords. Therefore, there may be some thyroglobulin, produced by these cells, circulating in your blood. However, after the thyroid remnant is destroyed by RAI, these normal cells are no longer contributing to thyroglobulin production. In the future, if thyroglobulin is detected in your blood, your physician knows that it must be produced by residual or recurrent thyroid cancer. In addition, RAI ablation of the thyroid remnant typically allows for clearer pictures (during radiology scans) of your neck in the future. However, many low-risk patients are followed without having received remnant ablation.

RAI Effect on Cancer Cells

Some thyroid cancer cells also share the same ability as normal thyroid cells to take up iodine from the bloodstream. These are referred to as "iodine-avid". If your cancer cells are able to do this, then I-131 may also destroy microscopic residual thyroid cancer cells or be used as a treatment for thyroid cancer that has spread to lymph nodes or other areas of the body. Doctors cannot tell by simply looking at the thyroid cells under the microscope if they can take up iodine. Determination of whether a patient's thyroid cancer is iodine-avid depends on many factors such as the type of cancer and results of imaging studies, including whole body scans (see section on Treatment Procedure below).

Preparing for Treatment
Although I-131 is a pill, you cannot simply take the pill without prior preparation. To prepare you for I-131 therapy and to maximize the effects I-131, there are two things that must happen.

First, you must follow a low iodine diet for 1-2 weeks to deplete your body of iodine. Iodine is found in many foods that we eat. This will make your thyroid cells "hungry" for the I-131 and help to increase the amount of I-131 that gets taken up. Foods rich in iodine that you should avoid include cranberries, organic yogurt, organic navy beans, organic potatoes, and organic cheeses.

Second, the blood level of a hormone called TSH (thyroid stimulating hormone) must be high. TSH is what signals the thyroid cells to produce thyroid hormone and, as discussed above, the first step in thyroid hormone production is for the thyroid cells to take up iodide from the bloodstream. Therefore, to maximize the amount of I-131 that enters the thyroid cells, your TSH level must be high.

There are two ways to raise your TSH blood concentration and your medical team will advise you as to which method they will use.

- You may receive injections of a medication called Thyrogen over two days prior to your I-131 therapy. Thyrogen is recombinant TSH and these injections will elevate the TSH level in your blood, which in turn stimulates the thyroid cells to take up the I-131. You will continue to take your usual thyroid hormone pill during this time, so you will not have any "hypothyroid" (low thyroid hormone) symptoms.
- Alternatively, you may be told to stop taking your thyroid hormone pill for about 2-3 weeks. Your body will sense that your thyroid hormone levels are low and will try to stimulate thyroid hormone production by producing large amounts of TSH (your body does not know that your thyroid gland has been removed). During the time that you are not taking any thyroid hormone, you will experience some hypothyroid (low thyroid levels) symptoms. These may include: difficulty concentrating, fatigue, blue or sad mood, puffiness around the eyes, dry skin, water retention, weight gain, constipation and fatigue. Once you restart your thyroid hormone after the I-131 therapy, it may take several weeks for these symptoms to completely resolve.

**Treatment Procedure**

Prior to treatment, patients will have a "whole body scan" that is performed one day after taking a small dose of a different radiiodine isotope (I-123). I-123 does not destroy thyroid cells and will allow your treatment team to visualize the location and amount of any remaining thyroid remnant and possibly thyroid cancer. After the whole body scan is completed, you will then receive the oral I-131 treatment pill. After taking the I-131, you will be sent home or, rarely, you may be required to remain in the hospital for a few days. You will be asked to return to the nuclear medicine department 7-10 days later to have another whole body scan, also known as the "post-therapy scan," that will show where the I-131 was deposited in your body. This scan may also identify any new sites of iodine-avid thyroid cancer not seen on the first whole body scan.

**Safety After Treatment**

I-131 remains in your system for up to a few weeks and excess not taken up by the thyroid is excreted in urine, stool, saliva and perspiration over the first 1-2 days following treatment. As the radioactivity of the I-131 in your system is a concern for those around you, you need to follow radiation safety precautions after receiving I-131. The length of time one has to follow these precautions is partly dependent on the dose of I-131, so the following recommendations need to be individualized. To keep those around you safe, in general, you should stay 3 feet away from them for the first 5 days (10 feet away for the first 24 hours). In addition your team will provide you with detailed precautions for the first week after treatment, which may include:

- Drive alone if possible. Do not sit next to someone in the car for more than an hour – ride in the backseat.
- Do not share food, drinks or eating utensils with others. Do not prepare food for others. Wash your dishes by hand or in the dishwasher – it is best to not use paper products.
- Sit when urinating to avoid any splashing and wipe dry with toilet tissue after to avoid dripping.
- If you share a phone with others, wipe the mouthpiece after use.
- Any trash items that contain your body fluids (menstrual pads, bandages, plastic utensils) should be put in a specific trash bag. Ask your treatment team how to dispose of this trash.
Your treatment team will specify how long you need to follow the following precautions, as they are dependent on the dose you receive:

- Do not sleep in the same bed as someone else. Do not share bed or bath linens and wash these and undergarments separately.
- Refrain from kissing anyone or having any sexual activity.
- Pets should not sleep with you to limit their exposure.

- Women should not become pregnant for 6–12 months after treatment. Men should not father a child for at least 3 months after treatment. Women should not breastfeed after I-131 treatment; but may be able to breastfeed with future pregnancies.
- Encourage friends and family to "visit" by phone and not in person for the first week to reduce their exposure.

Talk with your treatment team if you cannot follow any of these instructions due to your personal situation. Ask them about when it is safe to return to work or school, go out in public or when longer distance travel is safe. For up to 2 months, the radiation you were treated with can set off detectors at airports and other security checkpoints. Talk with your team if you need to travel within this time frame.

**Resources for More Information**

ThyCa: Thyroid Cancer Survivors' Association, Inc.

National Cancer Institute Thyroid Cancer Page

American Thyroid Association Radioactive Iodine FAQ's