



## Radioembolization (Y90)

Radioembolization is a minimally invasive procedure that combines embolization and radiation therapy to treat liver cancer. Tiny glass or resin beads filled with the radioactive isotope yttrium Y-90 are placed inside the blood vessels that feed a tumor. This blocks the supply of blood to the cancer cells and delivers a high dose of radiation to the tumor while sparing normal tissue. It can help extend the lives of patients with inoperable tumors and improve their quality of life.



Your doctor will tell you how to prepare and instruct you on eating or drinking before the procedure. Tell your doctor if there's a possibility you are pregnant or breastfeeding and discuss any recent illnesses, medical conditions, allergies and medications you're taking, including herbal supplements and aspirin. You may be advised to stop taking aspirin, nonsteroidal anti-inflammatory drugs (NSAIDs) or blood thinners several days prior to your procedure. Leave jewelry at home and wear loose, comfortable clothing. You may be asked to wear a gown. Have someone drive you home afterward, and plan to have your contact with children and adults restricted for three to seven days.

## What is Radioembolization

Radioembolization is a combination of radiation therapy and a procedure called embolization to treat cancer of the liver.

Embolization is a minimally invasive treatment in which blood vessels or malformations within blood vessels are occluded, or blocked off, to prevent blood flow.

Radiation therapy is the use of a certain type of energy, called ionizing radiation, to kill cancer cells and shrink tumors. Unlike external beam therapy (EBT), in which high-energy x-ray beams generated by a machine are directed at the tumor from outside the body, radioembolization involves placing a radioactive material directly inside the body. This form of treatment is called internal radiation therapy.

In radioembolization, tiny glass or resin beads called microspheres are placed inside the blood vessels that feed a tumor in order to block the supply of blood to the cancer cells. Once these microspheres,

which are filled with the radioactive isotope yttrium Y-90, become lodged at the tumor site, they deliver a high dose of radiation to the tumor and not to normal tissues.

## What are some common uses of the procedure?

Radioembolization is used to treat tumors that were initially formed in the liver or have spread (or metastasized) to the liver from another part of the body. It is a palliative treatment, which means it does not provide a cure but instead helps slow down the growth of the disease and alleviate symptoms. The procedure is an option for patients who are not candidates for other treatments, including surgery or liver transplantation.

## How should I prepare?

Several days before the procedure, you will have an office consultation with the interventional radiologist who will perform 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.

You will also receive an angiogram that will produce pictures of the blood vessels feeding the tumor seven to 10 days before your procedure.

You will need to make plans for your return home following your procedure as your contact with children and adults may be restricted for three to seven days.

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.

Also inform your doctor about recent illnesses or other medical conditions.

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 will receive specific instructions on how to prepare, including any changes that need to be made to your regular medication schedule.

You will be given a sedative prior to the procedure. You will receive specific instructions on eating and drinking before the procedure and will need to have a relative or friend accompany you and drive you home afterward.

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

## What does the equipment look like?

X-ray equipment, a catheter and microspheres, or tiny glass beads filled with the radioisotope yttrium-90 are used in this procedure.

Radioembolization procedures are typically performed using x-ray guidance.

The equipment typically used for this examination consists of a radiographic table, one or two x-ray tubes and a television-like monitor that is located in the examining room. Fluoroscopy, which converts x-rays into video images, is used to watch and guide progress of the procedure. The video is produced by the x-ray machine and a detector that is suspended over a table on which the patient lies.

A catheter is a long, thin plastic tube that is considerably smaller than a "pencil lead", or approximately 1/8 inch in diameter.

Millions of glass beads, amounting to about half a teaspoon full, each of which is smaller in diameter than a human hair, deliver the ionizing radiation.

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?

Using x-ray imaging and a contrast material to visualize the blood vessels, the interventional radiologist inserts a catheter through the skin into a blood vessel and advances it to the treatment site. The radiation-filled microspheres, or glass beads, are then inserted through the catheter and advanced to the blood vessels supplying the tumor with blood.

Once the microspheres lodge at the tumor site, they deliver a high dosage of radiation directly to the cancer cells. The microspheres will block the flow of blood to the tumor, depriving the diseased cells of the oxygen and nutrients needed to grow.

There are two primary blood vessels that bring blood to the liver. Normal liver tissue receives about 75 percent of its blood supply from the portal vein and about 25 percent from the hepatic artery and its branches. When a tumor grows in the liver, it receives almost all of its blood supply from the hepatic artery. Because radioactive microspheres are delivered through the hepatic artery, they reach the tumor very directly while sparing most of the healthy liver tissue.

The radiation from yttrium-90 continually decreases over a two-week period and disappears after 30 days. The tiny microspheres remain in the liver without causing any problems.

## How is the procedure performed?

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

An initial arteriogram as described below is performed to visualize the upper abdominal arteries. At that time, arteries to areas of the stomach and duodenum which may have beads flow into them are closed with tiny coils of wire. At the end of the procedure, a bead with a nuclear medicine tracer on it is injected through the catheter to simulate the treatment. This will allow the interventional radiologist to calculate how much of the treatment dose can go to the lungs so that lung damage does not occur.

This procedure is often done on an outpatient basis. However, some patients may require admission following the procedure. Please consult with your physician as to whether or not you will be admitted.

You may be given medications to help prevent nausea and pain, and antibiotics to help prevent infection.

You will be positioned on your back.

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 sedative medication can be given intravenously. Moderate sedation may be used. As an alternative, you may receive general anesthesia.

The area of your body where the catheter is 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.

Using image-guidance, a catheter (a long, thin, hollow plastic tube) is inserted through the skin into the femoral artery, a large groin blood vessel, and maneuvered to the treatment site.

Once the catheter is positioned in the branches of the hepatic artery that are feeding the tumor, the tiny glass beads or microspheres are injected through the catheter to the site. Over the next 10 to 14 days, the radiation will be released from the microspheres lodged in the blood vessels.

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

Your intravenous line will be removed.

This procedure is usually completed within an hour.

## **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.

You may feel slight pressure when the catheter is inserted, but no serious discomfort.

As the contrast material passes through your body, you may experience a warm feeling which quickly subsides.

Radioembolization is generally painless; however, some patients may experience brief pain when the microspheres are injected. Pain that continues for more than six to eight hours usually means an ulcer has developed in the patient's stomach or duodenum. These ulcers would be treated as any other ulcer.

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

Few patients experience some side effects called post-embolization syndrome, including nausea, vomiting and fever. Pain is the most common side effect that occurs because the blood supply to the treated area is cut off. It can readily be controlled by medications given by mouth or your IV.

These side effects usually subside within three to five days and may be alleviated with medication. You should tell your doctor if these symptoms last more than seven to 10 days.

You may also experience a low grade fever, lethargy and fatigue that usually last about one week.

You should be able to resume normal activities within a day or two following the procedure.

During the week following your radioembolization, you will need to limit contact with others while the radiation in your body diminishes. You should not do the following for at least seven days after the procedure:

- sleep in the same bed as your partner.
- use public transportation that requires you to sit next to another person for more than two hours.
- come in close contact with children or pregnant women.

Radioembolization may be performed in two separate treatments if there are tumors on both sides of the liver. CT scans or MRI may be performed every three months following the treatment to determine the size of the treated tumor.

## Who interprets the results and how do I get them?

The interventional radiologist can advise you as to whether the procedure was a technical success when it is completed.

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

- For patients with inoperable tumors, radioembolization can extend lives from months to years and improve quality of life. In some cases, it may allow for more curative options such as surgery or liver transplantation.
- Radioembolization produces fewer side effects compared to standard radiation therapy.
- No surgical incision is needed—only a small nick in the skin that does not have to be stitched.
- A higher dose of radiation to the tumor is given during radioembolization than with standard external beam therapy.

### Risks

- 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.
- There is a very slight risk of an allergic reaction if contrast material is injected.
- Any procedure that involves placement of a catheter inside a blood vessel carries certain risks. These risks include damage to the blood vessel, bruising or bleeding at the puncture site, and infection. However precaution is taken to mitigate these risks.
- There is a risk that the microspheres may lodge in the wrong place, putting the patient at risk for an ulcer in the stomach or duodenum. This happens in approximately two percent of patients.
- There is a risk of infection after radioembolization, even if an antibiotic has been given.
- Because angiography is part of the procedure, there is a risk of an allergic reaction to the contrast material.

## What are the limitations of Radioembolization?

Radioembolization is not recommended in cases of severe liver or kidney dysfunction, abnormal blood clotting or a blockage of the bile ducts. In some cases—despite liver dysfunction—radioembolization may be done in small amounts and in several procedures to try and minimize the effect on the normal liver.

Radioembolization is a treatment, not a cure. Approximately 70 to 95 percent of the patients will see improvement in the liver and, depending on the type of liver cancer, it may improve survival rates. Multiple studies show that up to 95 percent of patients with colorectal metastases (tumors that have spread) and up to 97 percent of patients with neuroendocrine tumors benefit from radioembolization.

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