Radioembolization (Y90)



Radioembolization is a minimally invasive procedure that combines embolization and radiation therapy to treat cancers in the liver. Tiny beads filled with a radioactive isotope are placed inside the blood vessels that supply a tumor. This 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 minimally invasive outpatient procedure that involves the precise placement of microscopic radioactive spheres (microspheres) via a small catheter placed directly in blood vessels that supply a tumor in the liver. The microspheres contain an isotope of yttrium-90 (http://www.radiologyinfo.org) , which generates therapeutic radiation before decaying away and becoming inactive. The majority of the radiation (~85%) is delivered within the first week, and there is less than 0.1% of the radiation left 1 month after the procedure.

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 (http://www.radiologyinfo.org)) to the liver from another part of the body. Radioembolization can effectively treat tumors as a sole therapy, help make some tumors eligible for curative surgery, and improve the quality of life in patients with liver cancers (https://www.radiologyinfo.org/en/info/fatty-liver-disease) .

How should I prepare?

Several days before the procedure, you will have a clinic consultation with the interventional radiologist (http://www.radiologyinfo.org) who will perform your procedure.

Prior to your procedure, your blood may be tested to determine how well your liver and kidneys are functioning and whether your blood clots normally.

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 to contrast materials (http://www.radiologyinfo.org) . Your doctor may tell you to stop taking aspirin, nonsteroidal anti-inflammatory drugs (NSAIDs) or blood thinners before your procedure.

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Tell your doctor about recent illnesses or other medical conditions.

Women should always inform their physician and radiologic 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 (http://www.radiologyinfo.org) to radiation. If an x-ray is necessary, precautions will be taken 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.*

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

You may be given a sedative prior to or during your treatments. 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, nuclear medicine equipment, catheters (http://www.radiologyinfo.org) , and a box containing radioactive microspheres are used in this procedure. The microspheres are about the size of powdered sugar, and less than a teaspoon of them is used for treatment.

The equipment typically used for this examination consists of a radiographic table, one or two x-ray tubes and a television-like monitor 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.

Oher equipment that may be used during the procedure includes an intravenous (http://www.radiologyinfo.org) line (IV), ultrasound machine and devices that monitor your heart beat and blood pressure.

How does the procedure work?

There are two blood vessels that bring blood to the liver. Normal liver tissue receives about 75 percent of its blood supply from the portal vein (http://www.radiologyinfo.org) and about 25 percent from the hepatic artery.

When a tumor grows in the liver, it receives almost all its blood supply from the hepatic artery. When microspheres are delivered through the hepatic artery, they accumulate preferentially in the tumor as opposed to the normal liver. Your interventional radiologist will only deliver microspheres to the portion of liver that contains tumor when possible.

In contrast to traditional external beam radiation therapy (http://www.radiologyinfo.org) , the radiation provided by radioembolization only travels a few millimeters from the microsphere. This property allows radioembolization to achieve high doses of radiation within the tumor, while preserving unaffected liver tissue from the effects of radiation.

The microspheres will remain in the treated portion of your liver without causing any future problems. A small portion of microspheres may go to the lungs during treatment, but do not cause issues in most patients.

Some patients receive radioembolization with the specific goal of making them a better candidate for surgery. This treatment, commonly referred to as a radiation lobectomy, involves the infusion of radioactive microspheres to both tumor and the portion of liver the surgeon intends to remove. This treatment approach is enabled by the liver’s unique ability to regenerate, just like skin or bone. Over three to six months after radiation lobectomy, radiation effects in the treated tumor and liver will cause them to shrink while the untreated portion of liver - which will remain with the patient after surgery – grows, thereby reducing the chance of postoperative liver failure.

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How is the procedure performed?

Radioembolization is performed by a specially trained interventional radiologist in an interventional radiology (http://www.radiologyinfo.org) suite. Although radioembolization can be performed in one session in certain circumstances, it will commonly require two sessions. In the first session, a mapping angiogram, as described below, is performed to visualize the abdominal arteries.

This procedure is often done on an outpatient basis. Rarely, some patients may require admission following the procedure. Ask your doctor if you will need to 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, oxygen level and pulse.

A nurse or radiologic technologist will insert an intravenous (IV) line into a vein in your hand or arm to administer a sedative. This procedure may use moderate sedation. It does not require a breathing tube. However, some patients may require 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. This may briefly burn or sting before the area becomes numb.

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 radial or femoral artery, and maneuvered to the treatment site.

A small catheter is placed within multiple arteries in the liver and a cone beam CT is performed to analyze its three-dimensional blood supply.

Your interventional radiologist will choose the arteries that are supplying tumor and prescribe a personalized radiation dose to them. Occasionally, arteries that the interventional radiologist wishes to protect from unintentional exposure to radioactive microspheres, such as those that supply stomach and bowel, will be closed with tiny metallic coils.

At the end of the procedure, a dissolvable particle made of protein containing a nuclear medicine tracer may be infused through the catheter into the liver to simulate treatment. This helps the interventional radiologist determine if you are a candidate for radioembolization based on the distribution of the simulated microspheres within the liver, abdomen, and lungs.

If you are determined to be a candidate for radioembolization after your mapping angiogram and nuclear medicine exam, you will be brought back for a second procedure typically within two weeks where the therapeutic radioactive microspheres will be administered in a similar procedure. In some practices, a radiation oncologist or nuclear medicine doctor will additionally be present in the room and will be performing the actual delivery of the therapeutic radioactive microspheres.

When the procedure is complete, the catheter is removed, and pressure is applied to stop any bleeding. Sometimes, your doctor may use a closure device to seal the small hole in the artery. This will allow you to move around more quickly. No stitches are visible on the skin. The tiny opening in the skin is covered with a dressing.

Your IV line is removed before you go home.

This procedure is usually completed within two hours.

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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 pinch when the needle is inserted into your vein for the IV line and when the local anesthetic is injected. Most of the sensation is at the skin incision site. This is numbed using local anesthetic. You may feel pressure when the catheter is inserted into the vein or artery. However, you will not feel serious discomfort.

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 feel warm. This will quickly pass.

Radioembolization is generally painless; however, some patients may experience brief pain when the microspheres are injected. Pain may develop in certain tumors over days to weeks due to normal inflammation related to tumor treatment. Rarely, pain in the upper abdomen may indicate the presence of a radiation-induced stomach or duodenum (http://www.radiologyinfo.org) ulcer. These ulcers can be treated with medication and rarely need more invasive therapy.

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

Occasionally, patients whose treatment requires a large number of microspheres experience post-embolization syndrome (http://www.radiologyinfo.org) due to a temporary reduction in blood supply in the liver. Symptoms include nausea, vomiting, and fever. This can readily be controlled by medications given by mouth or your IV. These side effects usually subside within one to five days. You should tell your doctor if these symptoms last more than 10 days. This is much less common with radioembolization (Y90) than other liver embolization procedures like chemoembolization (TACE) or bland embolization.

When larger volumes of liver are treated, patients may experience a loss of appetite and fatigue that may start within a week and last up to a month or more in severe cases. However, this is rare, and most patients will be able to resume normal activities within days following the procedure.

The type of radiation given off by Y90 remains largely confined to the liver, but your doctor may recommend limiting contact with others for the first week following your radioembolization while the radiation in your body diminishes. You may be provided with specific recommendations by your doctor's radiation safety officer, which may include warnings against:

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

CT scans (http://www.radiologyinfo.org) or MRIs (http://www.radiologyinfo.org) and laboratory examinations may be performed every one to three months following the treatment to determine treatment response. If a large volume of liver is treated, it can take three to six months to see effects from the treatment. If a large amount of radiation is infused into a small area of liver, results can be seen as soon as one month after treatment.

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.

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

What are the benefits vs. risks?

Benefits

- Radioembolization can prevent the progression of tumors and extend lives from months to years while preserving a patient's quality of life. In select cases, it may enable curative surgery or liver transplantation. When very high-dose radioembolization is used, also known as ablative radioembolization or radiation segmentectomy, you may receive radioembolization as the only treatment for your tumor.
- Radioembolization produces few side effects when compared to other liver cancer therapies.
- No surgical incision is necessary—only a small nick in the skin that does not need stitches.
- 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 places 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. The doctor will take precautions to mitigate these risks.
- There is a small risk that the microspheres may lodge in the wrong place, which may result in an ulcer in the stomach or duodenum.
- Patients who have underlying liver disease, such as cirrhosis or multiple treatments with chemotherapy and receive radioembolization to large volumes of liver face a risk of transient or permanent liver failure.
- There is a risk of infection after radioembolization, even if an antibiotic has been given, particularly in patients who have had stents placed in their bile ducts. You may need a prolonged course of one or more antibiotics for up to 21 days if you have a biliary stent in place at the time of treatment.
- Occasionally, patients with large tumors are at risk for secondary radiation effects in their lungs, which can cause temporary or permanent respiratory issues. Patients at high risk for this side effect are usually identified during simulation, which is harmless to the lungs. Radioembolization treatment doses can be subsequently adjusted to a safe level, or the treatment can be cancelled when this is not possible.

What are the limitations of Radioembolization?

Radioembolization is not recommended in cases of severe liver dysfunction or where there is an unfavorable mapping angiogram or nuclear medicine simulation.

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