

Brachytherapy

Brachytherapy is a type of radiation therapy used to treat cancer. It places radioactive sources inside the patient to kill cancer cells and shrink tumors. This allows your doctor to use a higher total dose of radiation to treat a smaller area and avoid delivering radiation to some surrounding organs.

Your doctor will tell you how to prepare and whether you will need medical imaging. Your doctor may use a computer program to plan your therapy.



What is brachytherapy and how is it used?

Brachytherapy, also called internal radiation therapy (<http://www.radiologyinfo.org>) , places radioactive material (<http://www.radiologyinfo.org>) directly inside or next to the tumor. It uses a higher total dose of radiation to treat a smaller area than external beam radiation therapy (<http://www.radiologyinfo.org>) (EBRT) which directs high-energy x-ray beams at a tumor from outside the body.

Brachytherapy treats cancers throughout the body, including the:

- prostate - see the *Prostate Cancer Treatment* (https://www.radiologyinfo.org/en/info/pros_cancer) page
- cervix - see the *Cervical Cancer Treatment* (<https://www.radiologyinfo.org/en/info/cervical-cancer-therapy>) page
- head and neck - see the *Head and Neck Cancer Treatment* (<https://www.radiologyinfo.org/en/info/thera-brain>) page
- brain – see the *Brain Tumor Treatment* (<https://www.radiologyinfo.org/en/info/thera-brain>) page
- skin
- breast - see the *Breast Cancer Treatment* (<https://www.radiologyinfo.org/en/info/breast-cancer-therapy>) page
- gallbladder
- uterus
- vagina
- lung - see the *Lung Cancer Treatment* (<https://www.radiologyinfo.org/en/info/lung-cancer-therapy>) page
- rectum
- eye

Brachytherapy is seldom used in children. However, brachytherapy has the advantage of using a highly localized dose of radiation. This means that less radiation is delivered to surrounding tissue. This significantly decreases the risk of radiation-induced second malignancies, a serious concern in children. The treatment is most often used for rare pediatric cancers (rhabdomyosarcoma). About 250 children are diagnosed with these rare cancers each year in the U.S.

Brachytherapy may be temporary or permanent. Talk to your radiation oncologist (<http://www.radiologyinfo.org>) about the specifics of your treatment.

Temporary brachytherapy (<http://www.radiologyinfo.org>) places radioactive material inside a catheter for a specific amount of time and then removes it. It is given at a low-dose rate (<http://www.radiologyinfo.org>) (LDR), meaning a lower intensity over a

longer period of time, or high-dose rate (<http://www.radiologyinfo.org>) (HDR), meaning a higher intensity over a shorter period of time.

Permanent brachytherapy (<http://www.radiologyinfo.org>) is also called seed implantation. It puts radioactive seeds (about the size of a grain of rice) in or near the tumor permanently. After several months, the seeds lose their radioactivity. Sometimes, active seeds may trigger radiation detectors at security checkpoints. You may need a doctor's note to explain your situation to security personnel. Inactive seeds are harmless and rarely trigger metal detectors.

Who will be involved in this procedure?

Brachytherapy requires a treatment team. This team includes a radiation oncologist, medical physicist (<http://www.radiologyinfo.org>), dosimetrist (<http://www.radiologyinfo.org>), radiation therapist (<http://www.radiologyinfo.org>), nurse and, sometimes, a surgeon and/or anesthesiologist. The radiation oncologist is a highly trained doctor who specializes in treating cancer with radiotherapy (<http://www.radiologyinfo.org>). The radiation oncologist evaluates the patient, identifies the treatment and determines the appropriate therapy and radiation dose. In some cases, a surgeon will assist by placing treatment devices in the patient, and an anesthesiologist may assist in ensuring the patient is comfortable. The medical physicist, dosimetrist and radiation oncologist determine how to deliver the radiation and how much the patient can tolerate. The physicist and the dosimetrist then make detailed treatment calculations. The radiation therapist, a specially trained technologist, may help deliver treatment. The nurse provides information about the possible side effects. The nurse also helps manage care for treatment catheters. The radiation oncologist obtains consent from the patient and provides details about the treatment, its benefits and its potential toxicities.

What equipment is used?

The type of radioactive material used (iodine, palladium, cesium or iridium) depends on the type of treatment. In all types, the radiation source is encapsulated. This means it is enclosed within a non-radioactive metallic capsule often referred to as a "seed." This helps prevent the material from moving to other parts of the patient's body.

Permanent implants put radioactive seeds directly in the tumor using a special delivery device (<http://www.radiologyinfo.org>). This is usually done with ultrasound and/or x-ray imaging to ensure accurate placement.

Temporary implants use needles, catheters (<http://www.radiologyinfo.org>) or special applicators. After the device's accurate position is confirmed, the radiation sources are inserted. This is called "afterloading." The radiation oncologist may insert and remove the material by hand after placing the delivery device. Or, the oncologist may use a computer-controlled remote afterloading machine to insert the material. Medical imaging helps position the material to treat the tumor in the most effective way. A computer calculates the source position and the amount of time needed to deliver the desired radiation dose.

Who operates the equipment?

The radiation oncologist creates the overall treatment plan. A medical physicist and a radiation oncologist confirm and approve the treatment before delivery. Setup is verified by the radiation therapist, the medical physicist, and the radiation oncologist. A radiation therapist operates the equipment.

Is there any special preparation needed for the procedure?

Your doctor will tell you how to prepare for treatment. These preparations may include:

- Bowel preparation
- Pre-treatment ultrasound, MRI or CT scan
- Blood tests

- Electrocardiogram (<http://www.radiologyinfo.org>) (EKG)
- Chest X-rays

Your doctor may also use a computer to plan the treatment before the actual procedure.

How is the procedure performed?

Permanent brachytherapy:

Permanent brachytherapy inserts needles pre-filled with radioactive seeds into the tumor. The doctor will remove the needle and leave the seeds behind. Seeds may also be implanted using a device that inserts them individually at regular intervals. The procedure may use medical imaging to help position the seeds. The doctor may do more imaging tests later to verify seed placement.

Temporary brachytherapy:

Temporary brachytherapy places a delivery device, such as a catheter, needle, or applicator into or near the tumor. Medical imaging helps position the radiation sources. The doctor may insert the delivery device into a body cavity, such as the vagina or uterus (intracavitary). Or, the doctor may insert an applicator (needle or catheter) into body tissues (interstitial). The doctor may place an applicator on the surface of the skin to treat skin malignancies.

High dose-rate (HDR) treatments deliver radiation over 10 to 20 minutes per session. Low dose-rate (LDR) treatments deliver radiation over 20 to 50 hours. Pulsed dose-rate (PDR) treatments deliver radiation in periodic pulses.

HDR treatment is usually an outpatient procedure. However, some patients are admitted to the hospital for one to two days to have several HDR treatments using the same applicator. HDR treatment delivers a specified dose of radiation to the tumor in a short burst using a remote afterloading machine. The machine stores a powerful source of radioactive isotopes (Iridium-192) and protects personnel from unnecessary radiation exposure. The HDR treatment lasts about 10 to 20 minutes. The entire procedure (including placement of the delivery device) may take up to several hours. This may be repeated a couple times in a day before the delivery device is removed. Patients may receive up to 10 separate HDR treatments over one or more weeks.

LDR treatment delivers radiation at a continuous rate over one to two days. It requires an overnight stay at the hospital. This allows the delivery device to remain in place throughout the treatment period. PDR treatment delivers radiation similarly using periodic pulses (usually one per hour). The doctor may insert the material through the delivery device by hand and remove it later once treatment is complete.

Once treatment is complete, the doctor removes the delivery device from the patient.

What will I feel during this procedure?

Before treatment begins, the doctor may place an intravenous (<http://www.radiologyinfo.org>) (IV) line into your arm or hand to deliver medication. Depending on the site of the tumor and your doctor's recommendations, you may receive general anesthesia (<http://www.radiologyinfo.org>) and/or a sedative to make you feel sleepy. If anesthesia or heavy sedation is used, you will be moved to a recovery room afterwards. Depending on the type of treatment, you may return home the same day or be moved to a hospital room.

Patients who have an afterloaded implant (<http://www.radiologyinfo.org>) for temporary brachytherapy may hear a clicking or humming noise from the treatment machine. This occurs as the machine pushes the radioactive material into the treatment device previously placed at the tumor site. You will be alone during the procedure. However, you will be able to speak with your treatment team via a microphone. The team will be located nearby, where they can see and hear you. PDR treatment will allow you to have visitors between the treatment pulses. LDR treatment will require you to stay in the hospital. Visits are usually limited

to about 30 minutes per visitor per day. Children and pregnant women may not visit. No radiation remains in your body after temporary brachytherapy, so there is no risk to others.

Some LDR, PDR and HDR treatments require one or more days in the hospital and may cause discomfort. This may be due to the catheters or applicators and having to stay relatively still for a prolonged period. Your doctor will prescribe medication to relieve your pain. Most HDR treatments are delivered in the outpatient setting and are non-invasive.

After permanent brachytherapy, the implanted seeds' radioactivity decays with time, depending on which radioactive isotope is used. Ask your doctor if you should limit close contact with others, such as pregnant women or children. With temporary implants, the doctor removes all radioactive material before you return home. There is no risk of exposure after the doctor removes the delivery device and radiation sources.

Your doctor and/or treatment team will give you specific home-care instructions. It is uncommon to have tenderness and swelling in the treatment area or other symptoms. This will depend on your specific treatment. Most patients are able to resume normal activities within days or weeks. However, you may have a small risk of long-term side effects. Talk to your treatment team about how to manage them.

Your doctor may recommend a series of follow-up exams after treatment. These may include a physical check-up, imaging exam(s), and blood or other lab tests.

These visits help your doctor see if your condition is stable or has changed. They also allow you to discuss any treatment side effects with your doctor.

Disclaimer

This information is copied from the RadiologyInfo Web site (<http://www.radiologyinfo.org>) which is dedicated to providing the highest quality information. To ensure that, each section is reviewed by a physician with expertise in the area presented. All information contained in the Web site is further reviewed by an ACR (American College of Radiology) - RSNA (Radiological Society of North America) committee, comprising physicians with expertise in several radiologic areas.

However, it is not possible to assure that this Web site contains complete, up-to-date information on any particular subject. Therefore, ACR and RSNA make no representations or warranties about the suitability of this information for use for any particular purpose. All information is provided "as is" without express or implied warranty.

Please visit the RadiologyInfo Web site at <http://www.radiologyinfo.org> to view or download the latest information.

Note: Images may be shown for illustrative purposes. Do not attempt to draw conclusions or make diagnoses by comparing these images to other medical images, particularly your own. Only qualified physicians should interpret images; the radiologist is the physician expert trained in medical imaging.

Copyright

This material is copyrighted by either the Radiological Society of North America (RSNA), 820 Jorie Boulevard, Oak Brook, IL 60523-2251 or the American College of Radiology (ACR), 1891 Preston White Drive, Reston, VA 20191-4397. Commercial reproduction or multiple distribution by any traditional or electronically based reproduction/publication method is prohibited.

Copyright © 2025 Radiological Society of North America, Inc.