

Brachytherapy

This information is reviewed by a physician with expertise in the area presented and is further reviewed by committees from the American College of Radiology (ACR) and the Radiological Society of North America (RSNA), comprising physicians with expertise in several radiologic areas

What is Brachytherapy and how is it used?

Brachytherapy is one type of radiation therapy used to treat cancer. Radiation therapy is the use of a 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, brachytherapy involves placing a radioactive material directly inside or next to the tumor.

Brachytherapy, also called internal radiation therapy, allows a physician to use a higher total dose of radiation to treat a smaller area and in a shorter time than is possible with external radiation treatment.

Brachytherapy is used to treat cancers throughout the body, including the:

- prostate
- cervix
- head and neck
- skin
- breast
- gallbladder
- uterus
- vagina
- lung
- rectum
- eye

Brachytherapy may be either temporary or permanent:

In temporary brachytherapy, the radioactive material is placed inside or near a tumor for a specific amount of time and then withdrawn. Temporary brachytherapy can be administered at a low-dose rate (LDR) or high-dose rate (HDR).

Permanent brachytherapy, also called seed implantation, involves placing radioactive seeds or pellets (about the size of a grain of rice) in or near the tumor and leaving them there permanently. After several weeks or months, the radioactivity level of the implants eventually diminishes to nothing. The inactive seeds then remain in the body, with no lasting effect on the patient.

Who will be involved in this procedure?

The delivery of brachytherapy requires a treatment team, including a radiation oncologist, medical radiation physicist, dosimetrist, radiation therapist, and in some cases, a surgeon. The radiation oncologist is a physician who evaluates the patient and determines the appropriate therapy. He or she determines what area of the body to treat and how much radiation to deliver. In select cases, the surgeon will assist the radiation oncologist in placement of the brachytherapy devices, such as catheters or needles, into the patient. Together with the medical radiation physicist and the dosimetrist, the radiation oncologist determines what techniques to use to deliver the prescribed dose. The physicist and the dosimetrist then make detailed treatment calculations. The radiation therapists are specially trained technologists who may assist in delivery of the treatments.

What equipment is used?

For permanent implants, radioactive material (which is enclosed within small seeds or pellets) is placed directly in the site of the tumor using a specialized delivery device. For temporary implants, needles, plastic catheters or specialized applicators are placed in the treatment site. Different types of radioactive material may be used according to the type of brachytherapy; some types of radiation sources used in brachytherapy are: iodine, palladium, cesium, and iridium.

In all cases of brachytherapy, the source of radiation is encapsulated which means that the radioactive material is enclosed within a non-radioactive metallic capsule.

After accurate positioning of the device(s) has been confirmed, the radiation sources are then inserted (afterloaded). The radiation oncologist may insert and remove the radioactive material manually after placing the delivery device, or the source(s) of radiation may be inserted using a computer-controlled remote afterloading machine. X-rays, ultrasound, CT or MRI scans may be used to help position the radioactive material to most effectively treat the tumor. For treatment planning, a computer is used to help calculate the source position and the amount of time needed to deliver the correct dose of radiation to the tumor.

Who operates the equipment?

The equipment is operated by a medical radiation physicist, a licensed dosimetrist who is supervised by a physicist, or a radiation oncologist. The overall treatment plan is created by the radiation oncologist, who is a highly trained physician specializing in treating cancer with radiotherapy.

Is there any special preparation needed for the procedure?

Your physician will determine which preparations need to be done prior to your brachytherapy procedure. These may include:

- Bowel preparation
- Pre-treatment ultrasound, MRI or CT scan
- Blood tests
- Electrocardiogram (EKG)
- Chest X-rays

Your physician may also use computer programs to plan the brachytherapy before the actual treatment procedure.

A few days before your procedure, you will be given specific instructions on how to prepare for your brachytherapy procedure.

How is the procedure performed?

Permanent brachytherapy:

In permanent brachytherapy, also called seed implantation, needles that are pre-filled with the radioactive seeds are inserted into the tumor.

The needle or device is then removed, leaving the radioactive seeds behind. Seeds may also be implanted using a device that inserts them individually at regular intervals. X-rays, ultrasound or CT scans may be used to assist the physician in positioning the seeds. Additional imaging tests may be done after the implantation to verify seed placement.

Temporary brachytherapy:

In temporary brachytherapy, a delivery device, such as a catheter, needle, or applicator, is placed into the tumor using fluoroscopy, ultrasound, MRI or CT to help position the radiation sources. The delivery device may be inserted into a body cavity such as the vagina or uterus (intracavitary brachytherapy) or applicators (usually needles or catheters) may be inserted into body tissues (interstitial brachytherapy).

Treatments may be delivered at a high dose-rate (HDR) or a low dose-rate (LDR). Treatment may also be delivered in periodic pulses (pulsed dose-rate or PDR).

High-dose rate (HDR) brachytherapy is usually an outpatient procedure although patients are sometimes admitted to the hospital to have several HDR treatments using the same applicator. With HDR brachytherapy, a specified dose of radiation is delivered to the tumor in a short burst using a remote-afterloading unit. The treatment lasts only a few minutes although the entire procedure (including placement of the delivery device) may take up to several hours. This may be repeated several times in a day before the delivery device is removed and the patient returns home. Patients may receive up to 10 separate HDR brachytherapy treatments over one or more weeks.

With low-dose rate (LDR) brachytherapy, the patient is treated with radiation delivered at a continuous rate over several hours or days. A patient receiving LDR brachytherapy stays overnight at the hospital so the delivery device can remain in place throughout the treatment period. Pulsed dose-rate (PDR) brachytherapy is delivered in a similar way but the treatment occurs in periodic pulses (usually one per hour) rather than continuously.

The physician may insert the radioactive material manually through the delivery device and later remove the material and delivery device when the treatment is done.

Alternatively, the patient may be moved to a shielded treatment room that contains a remote afterloading unit, which inserts the radioactive material to the delivery device within the tumor site. The radioactive material is automatically withdrawn when someone enters the patient's room and when the treatment is completed.

When the treatment is completed, the delivery device is removed from the patient.

What will I feel during this procedure?

Before the brachytherapy procedure begins, an intravenous line may be inserted into your arm or hand to deliver anesthetic medications. Depending on the site of the tumor and your physician's recommendations, you may receive general anesthesia and/or a sedative to make you feel drowsy. If anesthesia or heavy sedation is used, you may be transferred to a recovery room after the procedure. Depending on the type of brachytherapy, you may return home the same day or moved to a hospital room.

Patients who have an afterloaded implant for temporary brachytherapy may hear a clicking or humming noise from the treatment machine as the radioactive material is being pushed to the tumor site. Although you will be alone during the procedure, you will be able to speak via a speaker with members of your treatment team, who will be located nearby, where they can see and hear you. If you are treated with pulsed dose-rate brachytherapy, you may have visitors between the treatment pulses. With low dose-rate brachytherapy, visitors are usually limited to about 30 minutes per visitor per day.

With LDR, PDR, and some HDR brachytherapy treatments that require one or more days in the hospital, you may experience discomfort related to having to stay relatively still for a prolonged period of time. Your physician will prescribe medications to help relieve this.

Following permanent brachytherapy, in which radioactive seeds are implanted permanently in the body, the radioactivity of the seeds decays very quickly with time. However, you should discuss with your physician any recommendations for limiting close contact with others, such as pregnant women or children. For patients who have temporary implants, all radiation is removed before the patient returns home; there is no risk of radiation after the delivery device and radiation sources have been removed.

Your physician and/or treatment team will give you specific home-care instructions. You may experience tenderness and swelling in the treatment area or other symptoms depending on your specific procedure. Most patients are able to resume normal activities within days of brachytherapy. However, there may also be possible long-term side effects of radiation treatment. Members of your treatment team can advise you on managing the anticipated side effects of your brachytherapy treatment.

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 are 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 © 2009 Radiological Society of North America, Inc. Send comments via email to: webmast2@rsna.org