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<u>Home</u> > <u>Navigating Cancer Care</u> > <u>How Cancer is Treated</u> > <u>Radiation Therapy</u> > Understanding Radiation Therapy

PDF generated on June 25, 2016 from http://www.cancer.net/navigating-cancer-care/how-cancer-treated/radiation-therapy/understanding-radiation-therap y

## **Understanding Radiation Therapy** [1]

This section has been reviewed and approved by the Cancer.Net Editorial Board [2], 11/2015

#### What is radiation?

Radiation describes the way energy moves from one place to another. High-energy radiation, such as radiation from x-rays, has enough energy to change cells. When this happens, it can cause enough damage to destroy the cells. Such high-energy x-rays are used to destroy cancer cells in a treatment called radiation therapy.

#### The goals of radiation therapy

Doctors known as radiation oncologists oversee radiation therapy. This type of cancer therapy requires a specific number of treatments given over a set period of time. The goal of this treatment is to destroy cancer cells and slow tumor growth, without harming nearby healthy tissue.

Radiation therapy is used as the main cancer treatment and for another type of treatment, called adjuvant therapy. This type of therapy is given after the main treatment to target any remaining cancer cells.

Radiation therapy is also used to shrink tumors and reduce pressure, pain, and other symptoms of cancer. This kind of treatment is called <u>palliative radiation therapy</u> [3] and is used when it is not possible to completely cure the disease. The goal of this therapy is to improve a person's quality of life.

More than half of all people with cancer receive some type of radiation therapy. For some

cancers, radiation therapy alone is an effective treatment. However, other types of cancer respond best to combination treatments. This may include radiation plus surgery, chemotherapy, or immunotherapy.

#### Types of radiation therapy

**External-beam radiation therapy.** This is the most common type of radiation treatment. It delivers radiation from a machine located outside the body. It can treat large areas of the body, if needed. The machine used to create the radiation beam is called a linear accelerator or linac. Computers with special software adjust the size and shape of the beam. They also direct the beam to target the tumor while avoiding the healthy tissue near the cancer cells. External-beam radiation therapy does not make you radioactive.

Types of external-beam radiation therapy include:

- Three-dimensional conformal radiation therapy (3D-CRT): As part of this treatment, special computers create detailed three-dimensional pictures of the cancer. This allows the treatment team to aim the radiation more precisely. By doing this, they can use higher doses of radiation while reducing the risk of damaging healthy tissue. Studies have shown that 3D-CRT can lower the risk of side effects. For instance, it can limit the damage to the salivary glands, which can cause <u>dry mouth</u> [4], when people with head and neck cancer have radiation therapy.
- Intensity modulated radiation therapy (IMRT): This treatment directs the radiation dose at the tumor better than 3D-CRT by varying the intensity of the beam. IMRT protects healthy tissues from radiation better than 3D-CRT.
- Proton beam therapy: This treatment uses protons, rather than x-rays, to treat some cancers. Protons are parts of atoms that at high energy can destroy cancer cells. Directing protons at a tumor decreases the amount of radiation sent to nearby healthy tissue, reducing damage to this tissue. Because this therapy is relatively new and requires special equipment, it is not available at every medical center. The potential benefits of proton therapy compared to IMRT have not been established for some cancers, such as prostate cancer. Learn more about proton therapy [5].
- Stereotactic radiation therapy: This treatment delivers a large, precise radiation dose to a small tumor area. Because of the precision involved in this type of treatment, the patient must remain very still. Head frames or individual body molds are used to limit movement. Although this therapy is often given as a single treatment, some patients may need several radiation treatments.

**Internal radiation therapy.** This type of radiation treatment is also known as brachytherapy. Radioactive material is placed into the cancer itself or into the tissue surrounding it. These implants may be permanent or temporary and may require a hospital stay. Permanent implants are tiny steel seeds about the size of a grain of rice that contain radioactive material. These capsules are placed inside the body at the tumor site. The seeds deliver most of the radiation around the area of the implant. However, some radiation can be released from the patient's body. This means the patient should take precautions to protect others from radiation exposure while the seeds are active. Over time, the implant loses its radioactivity, but the inactive seeds remain in the body.

For temporary implants, the radiation is delivered through needles, tubes that carry fluid in or out of the body called catheters, or special applicators. These implants are kept in the body for a specific amount of time, from a few minutes to a few days. Most temporary implant procedures deliver radiation for just a few minutes. If temporary implants are used for more time, the patient remains in a private room to limit others' exposure to the radiation.

#### Other radiation therapy options

**Intraoperative radiation therapy (IORT).** Radiation therapy can be sent directly to the tumor during surgery for both external-beam and internal radiation therapy. This allows the surgeon to move healthy tissue out of the way before radiation therapy occurs. It may also be helpful when vital organs are very close to the tumor.

Systemic radiation therapy. Systemic or whole body radiation therapy uses radioactive materials that are swallowed or injected into the body to target cancer cells. These radioactive materials leave the body through saliva, sweat, and urine, making these fluids radioactive. People who come in close contact with the patient should take safety measures to protect themselves from the radiation. For more information, see the section below on Safety for the patient and family.

Radioimmunotherapy. A type of systemic therapy, this treatment uses monoclonal antibodies to deliver radiation directly to cancer cells. This therapy delivers low doses of radiation directly to the tumor while leaving noncancerous cells alone. Examples of these radioactive molecules include ibritumomab (Zevalin) and tositumomab (Bexxar).

**Radiosensitizers and radioprotectors.** Researchers are studying radiosensitizers, which are substances that help radiation better destroy tumors. Substances that better protect healthy tissues near the area being treated are called radioprotectors. Examples of radiosensitizers include fluorouracil (5-FU, Adrucil) and cisplatin (Platinol), while amifostine (Ethyol) is a radioprotector.

#### Safety for the patient and family

You can't see the radiation being used during your treatment. However, your radiation treatment team can control it using special computers and other equipment. Doctors have

safely and effectively used radiation to treat cancer for more than 100 years.

Most people cannot feel radiation from the machine, even during daily treatments, so there is no need to worry that a treatment session will be painful. A few people have reported a slight warming or tingling sensation in the area being treated.

Having radiation therapy slightly increases the risk of developing a second cancer. However, for many people, radiation therapy can eliminate the current, existing cancer. This benefit is far greater than the small risk that the treatment could cause a new cancer later in life.

During external-beam radiation therapy, the patient does not become radioactive. And, the radiation remains in the treatment room. However, because internal radiation therapy causes the patient to give off radiation, a number of safety measures are necessary.

Women who are pregnant and children younger than 18 should not visit the person receiving treatment. Other visitors should sit at least six feet from the patient's bed. They should also limit their stay to 30 minutes or less each day. Permanent implants remain radioactive after the patient leaves the hospital. Because of this, he or she should not have close or more than five minutes of contact with women who are pregnant and children for two months.

With systemic radiation therapy, use safety precautions for the first few days after treatment. The risk of radiation exposure to family and friends can be reduced by using the following precautions:

- Washing hands thoroughly after using the toilet
- Using separate utensils and towels
- Drinking plenty of fluids to flush the remaining radioactive material from the body
- Avoiding sexual contact
- Minimizing contact with infants, children, and women who are pregnant

#### **More Information**

How Cancer is Treated [6]

### [7]Additional Resources

RT Answers: How Does Radiation Therapy Work? [8]

National Cancer Institute (NCI): <u>What To Know About External Beam Radiation Therapy</u> [9] and <u>What To Know About Brachytherapy</u> [10]

RadiologyInfo.org [11]

#### Links

[1]

http://www.cancer.net/navigating-cancer-care/how-cancer-treated/radiation-therapy/understanding-radiation-therap y

[2] http://www.cancer.net/about-us

[3] http://www.cancer.net/node/31921

[4] http://www.cancer.net/node/25047

[5] http://www.cancer.net/node/24521

[6] http://www.cancer.net/node/25071

[7] http://www.cancer.net/navigating-cancer-care/how-cancer-treated

[8] http://www.rtanswers.org/treatmentinformation/treatmenttypes/howradiationtherapyworks.aspx

[9] http://www.cancer.gov/publications/patient-education/ebrt.pdf

[10] http://www.cancer.gov/publications/patient-education/brachytherapy.pdf

[11] http://www.radiologyinfo.org/