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Doctor-Approved Patient Information

Understanding Radiation Therapy

Approved by the Cancer.Net Editorial Board (http://www.cancer.net/about-us), **12/2016**

What is radiation?

Radiation is energy moving from one place to another. The energy may move through waves or particles. High-energy radiation, like x-rays, can change or destroy cells. Radiation therapy uses high-energy x-rays or proton beams to destroy cancer.

Goals of radiation therapy

Doctors called radiation oncologists oversee radiation therapy. They use this treatment to destroy cancer cells and slow tumor growth, without harming nearby healthy tissue.

Sometimes, doctors recommend radiation therapy as the primary cancer treatment. Other times, patients receive radiation therapy after surgery or chemotherapy. This is called adjuvant therapy. It targets cancer cells remaining after the primary treatment.

When it is not possible to destroy all of the cancer, doctors may use **palliative** (http://www.cancer.net/node/31921) radiation therapy to shrink tumors and relieve symptoms. This may reduce pressure, pain, and other symptoms. The goal is to improve a person's quality of life.

More than half of people with cancer receive some type of radiation therapy. For some cancers, radiation therapy alone is an effective treatment. Other types of cancer respond best to combination treatments. This may include radiation therapy plus surgery, chemotherapy, or immunotherapy.

External-beam radiation therapy

This is the most common type of radiation therapy. It delivers radiation from a machine outside the body. And it can treat large areas of the body, if needed.

A machine called a linear accelerator, or linac, creates the radiation beam for x-ray or photon radiation therapy. Special computer software adjusts the beam's size and shape. This helps target the tumor while avoiding healthy tissue near the cancer cells.

Most treatments are given every weekday for several weeks. Form-fitting supports or plastic mesh masks (for radiation therapy to the head, neck, or brain) help patients stay still during treatment.

The types of external-beam radiation therapy are:

Three-dimensional conformal radiation therapy (3D-CRT). Detailed 3-dimensional pictures of the cancer are created, typically from computed tomography (CT) or magnetic resonance imaging (MRI) scans. This allows the treatment team to aim the radiation more precisely. It often means they can safely use higher doses of radiation while reducing damage to healthy tissue. This lowers the risk of side effects. For instance, **dry mouth** (http://www.cancer.net/node/25047) is common after radiation therapy for head and neck cancer. But 3D-CRT can limit salivary gland damage that causes it.

Intensity modulated radiation therapy (IMRT). This a more complex form of 3D-CRT. The radiation intensity is varied within each beam in IMRT unlike conventional 3D-CRT, which uses the same intensity in each beam. IMRT targets the tumor and avoids healthy tissue better than conventional 3D-CRT.

Proton beam therapy. This treatment uses protons rather than x-rays. A proton is a positively charged particle. At high energy, protons can destroy cancer cells. The protons go to the targeted tumor and deposit the specific dose of radiation therapy. Unlike with x-ray beams, the radiation does not go beyond the tumor. This limits damage to nearby healthy tissue. Currently, doctors use proton therapy to treat certain cancer types. This therapy is relatively new and requires special equipment. Therefore, it is not available at every medical center. Learn more about **proton therapy** (http://www.cancer.net/node/24521) .

Image-guided radiation therapy (IGRT). This type of therapy allows the doctor to take images of a patient throughout treatment. These images can then be compared to the images used to plan treatment. It allows better targeting of the tumor and helps reduce damage to healthy tissue.

Stereotactic radiation therapy. This treatment delivers a large, precise radiation dose to a small tumor area. The patient must remain very still. Head frames or individual body molds help limit movement. This therapy is often given as a single or a few treatments. However, some patients may need several treatments.

Internal radiation therapy

This type of radiation therapy is also called brachytherapy. Radioactive material is placed into the cancer or surrounding tissue. Implants may be permanent or temporary and may require a hospital stay.

Types of internal radiation therapy include:

Permanent implants. These are tiny steel seeds that contain radioactive material. The capsules are about the size of a grain of rice. They deliver most of the radiation around the implant area. However, some radiation may exit the patient's body. This requires safety measures to protect others from radiation exposure. Over time, the implants lose radioactivity. And the inactive seeds remain in the body.

Temporary internal radiation therapy. Radiation therapy is given in one of these ways:

- Needles
- Tubes, called catheters, that carry fluid in or out of the body
- Special applicators

The radiation stays in the body for anywhere from a few minutes to a few days. Most people receive radiation therapy for just a few minutes. Sometimes, people receive internal radiation therapy for more time. If so, they stay in a private room to limit others' exposure to the radiation.

Other radiation therapy options

Intraoperative radiation therapy (IORT). This treatment delivers radiation therapy to the tumor during surgery using either external-beam or internal radiation therapy. IORT allows surgeons to move away healthy tissue in advance. This treatment is useful when vital organs are close to the tumor.

Systemic radiation therapy. Patients swallow or receive an injection of radioactive materials that target cancer cells. The radioactive materials leave the body through saliva, sweat, and urine. These fluids are radioactive. Therefore, people in close contact with the patient should take safety measures.

Radioimmunotherapy. This is a type of systemic therapy. It uses monoclonal antibodies to deliver radiation directly to cancer cells. This therapy delivers low doses of radiation directly to the tumor. It does not affect noncancerous cells. Examples include ibritumomab (Zevalin) and tositumomab (Bexxar).

Radiosensitizers and radioprotectors. Researchers are studying radiosensitizers. They are substances that help radiation therapy better destroy tumors. Radioprotectors are substances that protect healthy tissues near the treatment area. Examples of radiosensitizers include fluorouracil (5-FU, Adrucil) and cisplatin (Platinol). Amifostine (Ethyol) is a radioprotector.

Safety for the patient and family

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

Having radiation therapy slightly increases the risk of developing a second cancer. However, for many people, radiation therapy eliminates the existing cancer. This benefit is greater than the small risk that the treatment could cause a new cancer.

During external-beam radiation therapy, the patient does not become radioactive. And the radiation remains in the treatment room.

However, internal radiation therapy causes the patient to give off radiation. As a result, visitors should follow these safety measures:

- Don't visit the patient if you are pregnant or younger than 18.
- Stay at least 6 feet from the patient's bed.

- Limit your stay to 30 minutes or less each day.

Permanent implants remain radioactive after the patient leaves the hospital. Because of this, the patient should not have close or more than 5 minutes of contact with children or pregnant women for 2 months.

Similarly, patients who have had systemic radiation therapy should use safety precautions. For the first few days after treatment, take these precautions:

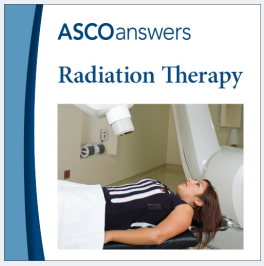
- Wash hands thoroughly after using the toilet.
- Use separate utensils and towels.
- Drink plenty of fluids to flush the remaining radioactive material from the body.
- Avoid sexual contact.
- Minimize contact with infants, children, and pregnant women.

More Information

How Cancer is Treated (http://www.cancer.net/node/25071)
What to Expect During Radiation Therapy (http://www.cancer.net/node/24661)
Side Effects of Radiation Therapy (http://www.cancer.net/node/24677)

Additional Resources

RT Answers: How Does Radiation Therapy Work? (http://www.rtanswers.org/What-is-Radiation-Therapy/)
National Cancer Institute (NCI): What to Know About External Beam Radiation Therapy (PDF) (https://www.cancer.gov/publications/patient-education/ebrt.pdf)
NCI: What to Know About Brachytherapy (PDF) (https://www.cancer.gov/publications/patient-education/brachytherapy.pdf)
RadiologyInfo.org: Introduction to Radiation Oncology (http://www.radiologyinfo.org/en/info.cfm?pg=intro_onco)



Download ASCO's free **Radiation Therapy** (http://www.cancer.net/sites/cancer.net/files/asco_answers_radiation_therapy.pdf) fact sheet. This 1-page printable PDF gives an introduction to radiation therapy, including an overview of the different types of radiation, what to expect during treatment, possible side effects, terms to know, and questions to ask the health care team. Order printed copies of this fact sheet from the **ASCO University Bookstore** (http://shop.asco.org/aart16_radiation-therapy-fact-sheet-pack-of-125-fact-sheets/).