

## Radiation Therapy

Radiation therapy is the use of high-energy radiation to damage cancer cells' DNA and destroy their ability to divide and grow. It may be delivered using machines called linear accelerators or via radioactive sources placed inside the patient on a temporary or permanent basis. Radiation therapy may be used to cure cancer, to relieve a cancer patient's pain or alleviate other symptoms.

Preparation for radiation therapy is focused on targeting the radiation dose to the cancer as precisely as possible to minimize side effects and avoid damaging normal cells. Imaging tests may be used to help determine the exact shape and location of your tumor and define its boundaries. Your doctor will give you specific instructions based on the type of exam being performed.



### Overview

An increasing number of patients have their cancers treated successfully using radiation therapy.

Modern technology has combined the use of three-dimensional imaging technology, computerized treatment planning and high-energy x-ray machines to make more precise treatment possible. Professionals involved in radiation therapy treatment include:

- Radiation oncologists
- Radiation therapists
- Radiation oncology nurses
- Medical radiation physicists
- Dosimetrists
- Social workers
- Dietitians

Click on any of the professionals listed above to learn more about that specialty.

### What is radiation therapy?

More than half of cancer patients are treated with radiation at some time during their course of treatment.

Radiation therapy is the use of high-energy radiation to treat cancer. A radiation oncologist may use radiation to cure cancer or to relieve a cancer patient's pain or alleviate other symptoms due to the cancer.

Radiation therapy works because the radiation destroys the cancer cells' ability to reproduce, and the body naturally gets rid of these cells. Radiation affects cancer cells by damaging their DNA, so that the cancer cells can no longer divide and grow.

Radiation is most effective at killing cells that are actively dividing. Cancer cells are more vulnerable to radiation for two reasons:

- they divide more rapidly than normal cells

- they do not repair this damage as effectively as normal cells

## How is radiation therapy used in cancer care?

A radiation oncologist may use external beam radiation therapy or brachytherapy to treat cancer. External beam radiation therapy can be generated by a linear accelerator (<https://www.radiologyinfo.org/en/info/linac>) (a machine that accelerates electrons to produce x-rays or gamma rays). Proton therapy (<https://www.radiologyinfo.org/en/info/protonthera>) is another form of external beam radiation therapy that uses cyclotrons or synchrotrons to produce charged atoms that destroy tumors.

Radiation therapy given by radioactive sources that are put inside the patient is called brachytherapy (<https://www.radiologyinfo.org/en/info/brachy>). The radioactive sources are sealed in needles, seeds, wires, or catheters, and implanted directly into or near a tumor on a temporary or permanent basis. Brachytherapy is a common treatment for *cancers of the prostate* ([https://www.radiologyinfo.org/en/info/pros\\_cancer](https://www.radiologyinfo.org/en/info/pros_cancer)), uterus, cervix or breast (<https://www.radiologyinfo.org/en/info/breast-cancer-therapy>).

Some cancer patients may be treated with radiation as their primary treatment. In some cases, radiation therapy is given at the same time as chemotherapy. Chemotherapy used with radiation therapy can improve the local response and reduce metastatic disease.

In other cases, radiation therapy is given before (neoadjuvant treatment) or after (adjuvant treatment) surgery.

## Radiation Therapy Process

After radiation therapy has been ordered, a planning stage occurs. The patient will first undergo a simulation scan on a special CT scanner. IV or oral contrast may be used. If a device is needed to keep the patient still (such as a mask) this is made at the simulation scan appointment.

The radiation oncologist then outlines the area to be treated, the tumor, and the areas to be avoided (such as normal organs). The radiation plan is developed and checked by dosimetrists, medical physicists and radiation oncologists. The radiation plan then undergoes quality and safety checks.

Radiation therapy is delivered on the treatment units by radiation therapists. The radiation oncologist along with other healthcare team members, including nurses and dietitians, will see the patient during radiation treatment to manage side effects.

## Radiation Therapy Techniques

Radiation can damage normal cells. It is important that the radiation be targeted to the cancer.

An advanced form of three-dimensional (3-D) conformal radiation, called intensity modulated radiation therapy, or IMRT (<https://www.radiologyinfo.org/en/info/imrt>), more precisely conforms the dose to the tumors, allowing safer delivery of higher doses of radiation.

Other techniques that enable ultra-precise doses of radiation to tumors include stereotactic radiosurgery (<https://www.radiologyinfo.org/en/info/stereotactic>), which uses 3-D imaging to determine the exact coordinates of a tumor. The highly focused gamma rays or x-rays then converge on the tumor to treat it. The Gamma Knife ([https://www.radiologyinfo.org/en/info/gamma\\_knife](https://www.radiologyinfo.org/en/info/gamma_knife))<sup>®</sup> is a treatment option that uses radioactive cobalt sources to focus multiple beams of radiation on a small area. Linear accelerators can also be used to deliver stereotactic radiation therapy to the brain. Other parts of the body can be treated with stereotactic body radiation therapy (SBRT). Emerging areas for using SBRT include lung, liver and bone.

Image-guided radiation therapy (IGRT (<https://www.radiologyinfo.org/en/info/igrt>)) is often used in conjunction with IMRT to

ensure the radiation is delivered to the planned area. IGRT involves performing a CT scan at the time of radiation treatment to ensure the target is aligned in the correct location. IGRT can allow for adjustments during treatment in areas of the body that are prone to movement, such as the lungs, and tumors located close to critical organs and tissues.

Radiation can also be used to cut off blood flow to a tumor in vascular organs like the liver. For instance, radioembolization (<https://www.radiologyinfo.org/en/info/radioembol>) uses microspheres filled with radioactive isotopes to block a tumor's blood supply and starve it.

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