Getting External Beam Radiation Therapy

External radiation (or external beam radiation) is the most common type of radiation therapy used for cancer treatment. A machine is used to aim high-energy rays or particles from outside the body at the tumor. External beam radiation is given most often as photon (x-ray) beams and less often as particle (proton, neutron) or electron beams (see below).

Radiation technology allows the very careful delivery of external beam radiation therapy. The machines focus the radiation beam on the exact location in such a way to maximize the radiation reaching the cancer, but also to affect normal tissues as little as possible.

External radiation is usually done during outpatient visits to a hospital or treatment center. Most people get external radiation therapy over many weeks. Usually, they visit the treatment center every weekday (Monday through Friday) for a certain number of weeks. But some people might get radiation on a different schedule, such as twice a day for a fewer number of weeks. Your cancer care team will speak with you about how much radiation is needed to treat your cancer and how often you need to get it.

Types of beams used in external radiation therapy

Photon beam radiation therapy: Photon beams are the same type of radiation that is used during an x-ray (like a chest x-ray), but the beams are much stronger. The radiation is released from the machine as a wave of energy. Photon beams can travel deep into the body to reach the tumor, but they can also damage healthy tissue in front of and behind the tumor.

Photons are given by a machine called a **linear accelerator.** The photon beams are invisible and cannot be felt when they are passing through the skin to reach the cancer.

Particle beam radiation therapy: Particle beams are made up of separate units of energy, such as protons or neutrons. The radiation is released from the machine as a stream of high-energy particles. Particle beams can travel deep into the body like photon beams, but their energy only is released at a certain distance. This means that this type of radiation can often be used to deliver more radiation to the tumor while limiting its effects on normal tissues in front of and behind the tumor.

Particle beams are given by special machines called **particle accelerators**, such as a cyclotron or synchrotron. The particle beams are invisible and cannot be felt when they are passing through the skin to reach the cancer.

Electron beam radiation therapy: Electron beams are also separate units of energy and can act like particle beams or can be converted into photon beam radiation. Electrons do not travel very far into the body, so they are most often used to treat cancers on the skin[1] or near the body surface.

Electron beams can be given from a linear accelerator or a particle accelerator. The electron beams are invisible and cannot be felt when they are aimed at the skin.

Types of external radiation therapy

Photon beam radiation therapy

Three-dimensional conformal radiation therapy (3D-CRT): 3D-CRT delivers radiation beams from different directions designed to match the shape of the tumor. This helps to reduce radiation damage to normal tissues and better kill the cancer cells by focusing the radiation dose on the tumor's exact shape and size.

Intensity modulated radiation therapy (IMRT): IMRT is like 3D-CRT, but it also changes the strength (intensity) of some of the beams in certain areas. This allows stronger doses to be aimed at certain parts of the tumor and helps lessen damage to nearby normal body tissues.

Helical tomotherapy is a form of IMRT that delivers radiation in a special way. For this treatment, the radiation machine delivers many small beams of radiation at the tumor from different angles around the body. This may allow for radiation to be even more precisely focused.

Stereotactic radiosurgery (SRS): This isn't really surgery, but a type of radiation treatment that gives a large dose of radiation to a small tumor area, usually in one session. It's used for brain tumors and other tumors inside the head. Once the exact location of the tumor is known from brain scans, radiation is aimed at the area from many different angles so it affects nearby tissues as little as possible. While it's called "radiosurgery" because of how exact it can be in terms of where it delivers the radiation, there is no cutting or incision involved.

When this type of treatment is used outside the brain, it is called **stereotactic body radiation therapy (SBRT)**. SBRT can be used for some lung, spine, liver, kidney, prostate, and other tumors.

In many radiation therapy clinics this technology is called by the name of the company that makes the machine. You might hear these names being used at the treatment center or when talking to your cancer care team or other patients.

- **X-Knife, CyberKnife, and Clinac:** These machine moves around to target the tumor from many different angles. Other brands of this type include **Synergy-S , Edge, Novalis,** and **TrueBeam**.

before each treatment. Using IGRT lets the radiation oncologist adjust the position of the patient or the aim of the radiation beams as needed to be sure that the radiation is focused on the tumor exactly and that exposure to normal tissues is limited.

MRI-guided radiation therapy: This approach, also known as **MRI-guided adaptive radiation therapy**, combines some features of IMRT, IGRT, and SBRT. It is done with a machine known as an **MRI-linac**, which combines an MRI scanner with a linear accelerator (linac, the machine that delivers the radiation).

As with other types of IGRT, MRI pictures can be taken before each treatment, so the aim of the radiation can be adjusted to account for any change in the position of the tumor since the last treatment.

MRI images can also be taken while the radiation is being given. If body functions (like breathing or digestion) cause the tumor to move out of the path of the radiation, the radiation stops until it is aimed correctly again. This can help reduce the amount of radiation to healthy tissues and organs around the tumor as much as possible.

MRI-linac machines are made by MRIdian and Elekta.

Intraoperative radiation therapy (IORT): This is external radiation given directly to the tumor or tumors during surgery. It may be used for tumors that can't be removed completely or when there's a high risk the cancer will come back in the same area. While you are asleep (under anesthesia), the surgeon moves normal tissues away from the tumor and protects them with special shields. This lets the doctor give one large dose of radiation to the cancer and limit the effects on nearby tissues. IORT is given in a special operating room.

Particle beam radiation therapy

Proton beam radiation therapy focuses beams of protons instead of photons (x-rays) on the cancer. Unlike photons, which go through the body and expose tissues to radiation both before and after they hit the tumor, protons only travel a certain distance, so the tissues behind the tumor are exposed to very little radiation. Even the tissues in front of the tumor see less radiation than the tumor itself. This means that proton beam radiation can deliver radiation to the cancer while doing less damage to nearby normal tissues.

Proton beam radiation might be used to treat tumors that are close to critical structures such as in the following cancers:

- Eye melanoma[2]

talk to you about the best plan in your case.

What happens during each treatment visit?

External radiation is a lot like getting a regular x-ray. The treatment itself is painless and takes only a few minutes. But each session can last 15 to 30 minutes because of the time it takes to set up the equipment and put you in the right position.

External radiation therapy is usually given with a machine called a linear accelerator which delivers a beam (or multiple beams) of radiation. The machine has a wide arm that extends over the treatment table. The radiation comes out of this arm. The machine can move around the table to change the angle of the radiation, if needed, but it won't touch you. The radiation beams are invisible and you will not feel anything, but the machine will make noise.

Depending on the area being treated, you might need to undress, so wear clothes that are easy to take off and put on. You'll be asked to lie on the treatment table next to the radiation machine.

The radiation therapist might put special heavy shields between the machine and parts of your body that aren't being treated to help protect normal tissues and organs.

Once you're in the right position, the radiation therapist will go into a nearby room to operate the machine and watch you on a TV screen. The room is shielded, or protected from the radiation so that the therapist isn't exposed to it. You can talk with the therapist over an intercom. You'll be asked to lie still during the treatment, but you won't have to hold your breath.

The machine will make clicking and whirring noises and might sometimes sound like a vacuum cleaner as it moves to aim the radiation beam from different angles. The radiation therapist controls the movement and checks to be sure it's working properly. If you're concerned about anything that happens in the treatment room, ask the therapist to explain. If you feel ill or uncomfortable during the treatment, tell the therapist right away. The machine can be stopped at any time.

Hyperlinks

1. www.cancer.org/cancer/types/skin-cancer.html
2. www.cancer.org/cancer/types/eye-cancer.html
3. www.cancer.org/cancer/types/prostate-cancer.html
4. www.cancer.org/cancer/types/head-neck-cancer.html

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