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Introduction to Cancer Therapy (Radiation Oncology)

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 accelerators or via radioactive sources placed inside the patient on a temporary or permanent basis. Radiation therapy can help reduce pain and suffering in patients with advanced cancer.

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

Shortly after the discovery of the x-ray by German physicist Wilhelm Conrad Roentgen in 1895, the "powerful rays" were being used to effectively treat cancer.

Today, an increasing number of patients have their cancers treated successfully, with fewer side effects and preservation of normal tissue function, 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 who use this technology or the information obtained from it include:

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

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

What is radiation therapy?

About 60 percent 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 key reasons: they divide more rapidly than normal cells, and they do not repair this damage as effectively as normal cells.

A radiation oncologist may use external beam radiation therapy generated by a linear accelerator (a machine that accelerates electrons to produce x-rays or gamma rays). Proton therapy is another form of external beam radiation therapy that uses cyclotrons or synchrotrons to produce charged atoms that destroy tumors.

Radiation may also be given with radioactive sources that are put inside the patient brachytherapy. 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, uterus, cervix or breast.

Some cancer patients may be treated with radiation alone instead of surgery. Prostate cancer and larynx cancer are often treated in this manner.

Sometimes radiation therapy is part of a patient's treatment. When radiation therapy is used after surgery, it is called adjuvant treatment. For example, a woman may have radiation therapy after breast conserving surgery. She can be cured of her cancer and still keep her breast.

Radiation can also be given before surgery and is then called neoadjuvant or induction radiation therapy, either to improve cure rates or make surgery easier to perform. Examples of this approach include treatment for esophageal, rectal or lung cancers.

Patients can be treated with radiation therapy and chemotherapy before surgery. Combined treatment may allow a patient to have less radical surgery than would otherwise be required. For example, some bladder cancer patients can keep their bladder if they are treated with all three treatments rather than only one treatment. Chemotherapy may be used simultaneously with radiation therapy without surgery to improve the local response and reduce metastatic disease; this is known as combined modality therapy.

In some cases, such as lung, head and neck or cervix cancers, combined modality therapy may be the only treatment needed without surgery.

Since radiation can damage normal cells, it is important that the radiation dose be targeted precisely to the cancer. Imaging also helps with treatment planning, allowing precise radiation delivery that spares

surrounding, healthy tissue and minimizes side effects and complications.

An advanced form of three-dimensional (3-D) conformal radiation, called intensity modulated radiation therapy or IMRT, more precisely conforms the dose to the tumors, allowing safer delivery of higher than conventional doses of radiation. Image-guided radiation therapy or IGRT is often used in conjunction with intensity-modulated radiation therapy (IMRT) to deliver precise radiation doses to a malignant tumor or even specific areas within the tumor. Recent developments like IGRT even 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.

Other techniques that enable ultra-precise doses of radiation to tumors include stereotactic radiosurgery, 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® 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 as well, and are considered stereotactic body radiation therapy (SBRT). Emerging areas for using SBRT include lung, liver and bone.

Radiation can also be used to cut off blood flow to a tumor in vascular organs like the liver. For instance, radioembolization uses microspheres filled with radioactive isotopes to block a tumor's blood supply and starve it.

In addition to being a treatment option for cancer, radiation therapy also is palliative; that is, it can help reduce pain and suffering in patients with advanced cancer. Patients with significant pain, trouble walking or difficulty eating because of a tumor can see an improved quality of life through palliative radiation.

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