An Introduction to Cancer Therapy

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 this 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 50 to 60 percent of cancer patients are treated with radiation at some time during their course of treatment.

Radiation therapy is the careful 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 destroys cancer cells by damaging their DNA. Radiation is most effective at killing cells that are actively dividing. Cancer cells are particularly vulnerable to radiation because they divide more rapidly than normal cells. Normal cells are able to repair this damage more efficiently.

A radiation oncologist may use radiation generated by a machine outside a patient's body external beam radiation therapy or proton therapy. In external beam therapy, a machine called a linear accelerator (www.radiologyinfo.org/en/info.cfm?pg=linac) generates radiation by accelerating electrons to produce x-rays or gamma rays. Proton therapy (www.radiologyinfo.org/en/info.cfm?pg=protonthera) 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 (www.radiologyinfo.org/en/info.cfm?pg=brachy) is a common treatment for cancers of the prostate (www.radiologyinfo.org/en/info.cfm?pg=pros_cancer), uterus, cervix or breast (www.radiologyinfo.org/en/info.cfm?pg=breastcancer).

A cancer patient may be treated with radiation alone. Prostate cancer and larynx cancer are often treated in this manner.

Sometimes radiation therapy is part of a patient's 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. When radiation therapy is only part of a patient's treatment it is called adjuvant treatment. Radiation can also be given before surgery and is then called neoadjuvant or induction radiation therapy. This approach can be used for esophageal cancer or lung cancer.

Patients can be treated with radiation therapy and chemotherapy before surgery. This 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.

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

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. Recent developments like image-guided radiation therapy (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.

IGRT (www.radiologyinfo.org/en/info.cfm?pg=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. Through modulation, or control, of the radiation beam, IMRT (www.radiologyinfo.org/en/info.cfm?pg=imrt) conforms the dose to the 3-D shape of the tumors, allowing safer delivery of higher than conventional doses of radiation.

Other techniques that enable precise doses of radiation to tumors include stereotactic radiosurgery (www.radiologyinfo.org/en/info.cfm?pg=stereotactic), which uses 3-D imaging to determine the exact coordinates of a tumor in the body. The highly focused gamma rays or x-rays then converge on the tumor to shrink it. The Gamma Knife® (/www.radiologyinfo.org/en/info.cfm?pg=gamma_knife) is a treatment option that focuses multiple beams of radiation on a small area and is ideal for treating brain tumors. Linear accelerators can also be used to deliver stereotactic radiation therapy to the brain or the

lung.

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.