New Connections
HELPING YOU FIND YOUR WAY THROUGH TREATMENT

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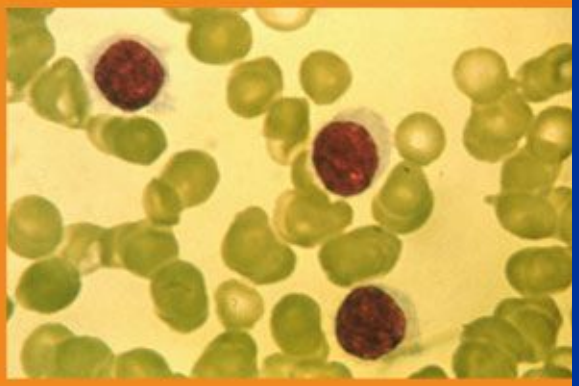
# Radiation Therapy:

## An overview of this common type of cancer treatment



Ever since radiation and radioactivity were discovered more than 100 years ago, science has looked for ways to use them to treat cancer. Advances in technology and a better understanding of the effects on the body have made radiation therapy an important part of cancer treatment. In fact, about half of all people with cancer will receive radiation as part of their treatment.

Radiation therapy is often the main treatment for certain types of cancer, but it is also used in combination with other treatments such as surgery or chemotherapy.

Radiation therapy uses high-energy particles or waves, such as X-rays, gamma rays, electrons, or protons to destroy or damage cancer cells. Other names for radiation therapy include radiotherapy or X-ray therapy.

Unlike chemotherapy, which exposes the entire body to cancer-fighting drugs, radiation therapy is usually a local treatment. It affects only the part of the body being treated.

## How does radiation therapy work?

All cells, whether cancerous or healthy, grow and divide to form new cells. Cancer cells, however, grow and divide more quickly than many of the normal cells around them.

Radiation therapy delivers high doses of radiation to cancerous cells, killing or damaging them so they cannot grow or spread. It works by breaking a strand of the DNA molecule inside the cancer cell, which prevents the cell from growing and dividing.

## It helps to understand how cells work

Cells grow and reproduce to replace cells lost during injury or during normal wear and tear. The cell *cycle* is a series of steps that both normal cells and cancer cells go through as they grow and reproduce.

There are five phases in the cell cycle with each phase designated by letters and numbers:

**G0 phase:** This is known as the resting phase - meaning cells have not yet started to divide. Cells spend much of their lives in this phase. Depending on the type of cell, this phase can last for a few hours to a few years. When the cell is signaled to reproduce, it moves into the G1 phase.

**G1 phase:** During this phase, the cell starts making more proteins to get ready to divide. This phase lasts about 18 to 30 hours.

**S phase:** During this phase, the chromosomes containing the genetic code (DNA) are copied so that both of the new cells formed will have the right amount of DNA. This phase lasts about 18 to 20 hours.

**G2 phase:** This phase occurs just before the cell starts splitting into two cells. It lasts from two to 10 hours.

**M phase:** During this phase, known as mitosis, the cell actually splits into two new cells. This phase lasts only 30 to 60 minutes.

This cell cycle is important in cancer treatment because radiation usually works best on cells that are actively or quickly dividing (the M phase). It doesn't work as well on cells that are in the resting phase (G0) or are dividing slowly.

## Radiation therapy may be used for several reasons

**To cure or shrink early stage cancer:** Some cancers are very sensitive to radiation. In these cases, radiation may be used by itself to make the cancer shrink or disappear completely. For other cancers, it may be used before surgery to shrink the tumor (pre-operative therapy) or after surgery to prevent the cancer from coming back (adjuvant therapy). It may also be used along with chemotherapy in some situations.

**To stop cancer from recurring in another area:** If a type of cancer is known to spread commonly to a particular area, doctors often assume that a few cancer cells may have already spread there, even though imaging scans (CT or MRI scans) show no tumors. That area may be treated to keep these cells from growing into tumors. For example, people with some types of lung cancer may receive prophylactic (preventive) radiation to the head because this type of cancer often spreads to the brain.

**To treat symptoms for advanced cancer**: Some cancers may spread too far to be considered curable. But this does not mean they can't be treated to make the person feel better. Radiation may help to relieve symptoms such as pain, trouble swallowing or breathing, or bowel problems that can be caused by advanced cancer. This radiation is often referred to as palliative radiation.

## There are two types of radiation therapy

Radiation therapy can be given externally or internally. Usually one or the other is used, but some patients receive both types of therapy.

**External radiation** (or external beam radiation) uses a machine that directs high-energy rays at the cancer. Most people receive external radiation therapy over several weeks during outpatient visits to a hospital or treatment center.

**Internal radiation** (brachytherapy) uses a radioactive wire or pellet that is usually sealed in a small container called an implant. The implant is placed inside the body in or near the tumor. The radiation from an implant travels only a short distance, so it has very little effect on normal body tissues.

Sometimes, after a tumor has been surgically removed, radioactive implants are put into the area around the incision to kill any tumor cells that may remain. Implants may either be left in the patient permanently or they may be removed after a certain amount of time.

Radiopharmaceuticals are another type of internal radiation therapy. They are radioactive drugs used for certain types of cancer, such as thyroid cancer or cancer that has spread to the bone (bone metastases). This is a type of unsealed radioactive source that is given by mouth or by injection and travels throughout the body. Treatment with radiopharmaceuticals often requires a brief stay in the hospital.

## Common forms of radiation treatment for cancer

- High-energy photons come from radioactive sources such as cobalt, cesium, or a machine called a linear accelerator (or *linac* for short.) This is by far the most common type of radiation treatment in use today.
- Electron beams produced by a linear accelerator are used for tumors close to a body surface since they penetrate less into deeper tissues.
- Protons are a newer form of treatment. Protons are parts of atoms that cause little damage to tissues that they pass through but they are very good at killing cells at the end of their path. This means that proton beams may be able to deliver more radiation to the cancer while causing fewer side effects to normal tissues nearby. Although proton beam radiation is used routinely for certain types of cancer, it still needs more study in others. Some of the techniques used in proton treatment can also expose the patient to neutrons (see below). Proton beam radiation therapy requires highly specialized equipment and is currently offered only in a few medical centers.
- Neutrons are used for some cancers of the head, neck, and prostate. They can sometimes be helpful when other forms of radiation therapy don't work. Their use has declined over the years because of the rather severe long-term side effects they cause.

In addition to these types of radiation therapies, there are also several new ways to deliver radiation to tumors, ways that are making radiation therapy safer and more effective. These range from 3-dimensional conformal radiation therapy (3D-CRT) which uses CT images and special computers to very precisely map the location of a cancer in three dimensions, to the use of substances called radiosensitizers, which make cancer cells more sensitive to the radiation without affecting normal tissues.

## Do the benefits outweigh the risks and side effects?

Radiation therapy may be more helpful in some situations than in others. For example, some types of cancer are more sensitive to radiation than others, and some cancers are in areas that are more easily treated with radiation without causing major side effects.

If your doctor is recommending radiation therapy, it is because he or she feels that the benefits you may get from it are likely to outweigh the possible side effects. Still, this is something you must be comfortable with. Knowing as much as you can about the possible benefits and risks can help you decide whether radiation therapy is best for you.

To learn more about all aspects of radiation, including possible side effects and questions to ask your doctor, click here.

Learn More

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