

# ***Radiation Therapy***

Radiation therapy is a cancer-fighting treatment that damages or destroys cancerous cells by preventing them from growing or dividing while minimizing adverse effects on nearby healthy organs and tissues. Radiation therapy does not actually remove the tumor, but the radiation causes it to shrink.

## **Simulation and Treatment Planning**

Patient treatment is planned and simulated in advance. The first step is a patient CT scan. CT images help create an outline of the tumor to be targeted, and the normal structures to be spared, allowing physicians to design the most effective treatment plan. This plan is created to maximize radiation to the patient's tumor and minimize radiation to normal tissues.

## **Treatment Methods**

Radiation therapy is delivered to patients externally or internally. External radiation therapy focuses high-energy X-ray (electron) beams delivered by a linear accelerator or proton beams and aimed at specific points on the body where the tumor is located. Alignment of the radiation beams to the tumor is critical for accuracy of the treatment. Internal radiation therapy involves a low-energy radioactive implant placed inside the body in or near the tumor.

## **External Radiation Therapy**

External radiation is the most common type of radiation therapy and can be delivered through a variety of technologies.

- **3D conformal radiation therapy (3D CRT)** follows the exact shape of the tumor, allowing for precise targeting. Using three-dimensional images of the tumor and the surrounding structures to develop a specialized treatment plan, the therapy uses multiple beams of radiation from varying angles. Each beam delivers a fraction of the dose. Where the beams join, the full dose is delivered. This technique allows delivery of high-dose radiation while limiting exposure to nearby healthy tissue.
- **Image guided radiation therapy (IGRT)** technologies increase the accuracy of the radiation delivery. IGRT can account for changes in the patient's body or position that may shift the exact location of the cancer. Imaging is taken before the treatment to compare previous imaging of a patient's tumor to current images to ensure the patient and the radiation beam are in alignment. Alignment changes are made immediately prior to treatment delivery if needed.
- **Intensity modulated radiation therapy (IMRT)** is an advanced form of noninvasive radiation treatment that precisely targets tumor cells. It uses computed tomography (CT) to create 3D images and treatment plans to deliver targeted radiation beams of varying intensity to cancerous tumors. By using image-guidance technologies, the physician can localize the patient's treatment and minimize damage to surrounding tissue.
- **Stereotactic radiosurgery (SRS) and stereotactic body radiotherapy (SBRT)** are non-surgical procedures that deliver precisely-targeted radiation at very high doses with minimal damage to surrounding healthy tissue. SRS uses a computer-guided therapy system to treat tumors and other abnormalities of the brain. SRS is ideal for otherwise inoperable tumors, such as those that cannot be treated by traditional surgical methods. SBRT is used in areas of the body other than the brain to treat malignant or benign small to medium size tumors.
- **Proton beam therapy** is an advanced type of radiation therapy aimed at destroying cancerous cells using protons. The treatment offers sub-millimeter precision that delivers high-energy proton beams directly to tumors, minimizing damage to surrounding healthy tissue. Proton therapy most often treats tumors in sensitive areas and is a beneficial option for treating pediatric cancers because it can minimize damage to their smaller and still-developing bodies.

## **Internal Radiation Therapy**

Internal radiation is also referred to as brachytherapy. Depending on the patient's specific cancer and treatment plan, the patient receives a temporary or a permanent implant. The implant becomes inert over time. Internal radiation therapy delivers a higher dose of radiation directly to the cancerous area than external radiation treatments.

- **Low dose rate (LDR) brachytherapy** uses radioactive materials inserted into body tissue in close proximity to the tumor in a permanent or temporary application. Low Dose Rate (LDR) brachytherapy delivers lower dose rates of radiation over a longer period before becoming inert. This therapy is administered through long-term or short-term implants.
- **High dose rate (HDR) brachytherapy** uses radioactive material inserted into applicators placed within body cavities or tissues to deliver a high dose of radiation precisely to the tumor.

*Sources: American Cancer Society, American Society of Clinical Oncology, and National Cancer Institute*