



## RADIATION THERAPY **FOR CANCER**



**Facts to Help Patients Make an  
Informed Decision**

# ASTRO

**The American Society for Therapeutic Radiology and Oncology**  
*Targeting Cancer Care*

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## ● ● ● INTRODUCTION

This booklet provides information for people living with cancer and their loved ones who are exploring radiation therapy as a treatment option. Radiation, alone or in combination with other cancer therapies, can be used to successfully treat many different types of cancer.

Learning you have cancer can bring on a flood of feelings and concerns. Finding out as much as you can about the disease and ways to treat it can be overwhelming and confusing. As you prepare for treatment, it may help to learn as much as possible about what you may experience.

Radiation therapy techniques and procedures may vary among different doctors, hospitals and treatment centers. Be sure to ask questions if you are concerned that the advice of your doctor is different from what you read here, on the Internet or in other publications.



REMEMBER, YOUR RADIATION ONCOLOGIST AND RADIATION ONCOLOGY NURSE ARE THE BEST PEOPLE TO MAKE RECOMMENDATIONS AND ANSWER QUESTIONS ABOUT YOUR CANCER.

## ● ● ● RADIATION THERAPY

### AND CANCER

Cancer doctors usually treat cancer with radiation therapy, surgery or medications including chemotherapy, hormonal therapy and/or biologic therapy, either alone or in combination.

If your cancer can be treated with radiation, you will be referred to a **radiation oncologist** — a doctor who specializes in treating patients with radiation therapy. Your radiation oncologist will work with your primary doctor and other cancer specialists, such as **surgeons** and **medical oncologists**, to oversee your care. He or she will discuss the details of your cancer with you, the role of radiation therapy in your overall treatment plan and what to expect from your treatment.



## DID YOU KNOW?

**Physicians have been treating patients with radiation therapy safely and effectively for more than 100 years. Nearly two-thirds of cancer patients are treated with radiation during their illness.**

## ● ● ● HOW DOES RADIATION THERAPY WORK?

**Radiation therapy**, or **radiotherapy**, is the use of various forms of radiation to safely and effectively treat cancer and other diseases. Radiation oncologists may use radiation to cure cancer, to control the growth of the cancer or to relieve symptoms, such as pain.

Radiation therapy works by damaging cells. Normal cells are able to repair themselves, whereas cancer cells cannot. New techniques also allow doctors to better target the radiation to protect healthy cells.

Sometimes radiation therapy is the only treatment a patient needs. At other times, it is only one part of a patient's treatment. For example, prostate and larynx cancer are often treated with radiotherapy alone, while a woman with breast cancer may be treated with surgery, radiation therapy and chemotherapy.

Radiation may also be used to make your primary treatment more effective. For example, you can be treated with radiation therapy before surgery to help shrink the cancer and allow less extensive surgery than would otherwise be needed; or you may be treated with radiation after surgery to destroy small amounts of cancer that may have been left behind.

A radiation oncologist may choose to use radiation therapy in a number of different ways. Sometimes the goal is to cure the cancer. In this case, radiation therapy may be used to:

- Destroy tumors that have not spread to other parts of your body.
- Reduce the risk that cancer will return after you undergo surgery or chemotherapy by killing small amounts of cancer that might remain.

Sometimes, the overall goal is to slow down the cancer as much as possible.

In other cases, the goal is to reduce the symptoms caused by growing tumors and to improve your quality of life. When radiation therapy is administered for this purpose, it is called **palliative care** or **palliation**. In this instance, radiation may be used to:

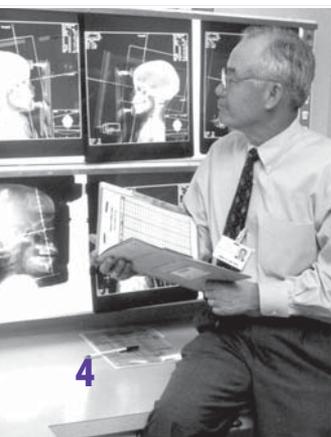
- Shrink tumors that are interfering with your quality of life, such as a lung tumor that is causing shortness of breath.
- Relieve pain by reducing the size of your tumor.

It is important for you to discuss the goal of your treatment with your radiation oncologist.

## ● ● ● WHAT ARE THE DIFFERENT KINDS OF RADIATION?

The goal of radiation therapy is to get enough radiation into the body to kill the cancer cells while preventing damage to healthy tissue. There are several ways to do this. Depending on the location, size and type of cancer, you may receive one or a combination of techniques. Your treatment team will help you to decide which treatments are best for you.

Radiation therapy can be delivered in two ways, externally and internally. During **external beam radiation therapy**, the radiation oncology team uses a machine to direct high-energy X-rays at the cancer. Internal radiation therapy, or **brachytherapy**, involves placing radioactive sources (for example, radioactive seeds) inside your body.



### DID YOU KNOW?

Radiation therapy works by damaging the DNA within cancer cells and destroying the ability of the cancer cells to reproduce. When these damaged cancer cells die, the body naturally eliminates them. Normal cells are also affected by radiation, but they are able to repair themselves in a way that cancer cells cannot.

## ● ● ● EXTERNAL BEAM RADIATION THERAPY



During external beam radiation therapy, a beam of radiation is directed through the skin to the cancer and the immediate surrounding area in order to destroy the main tumor and any nearby cancer cells. To minimize side effects, the treatments are typically given five days a week, Monday through Friday, for a number of weeks. This allows doctors to get enough radiation into the body to kill the cancer while giving healthy cells time each day to recover.

The radiation beam is usually generated by a machine called a **linear accelerator**. The linear accelerator, or **linac**, is capable of producing high-energy X-rays and electrons for the treatment of your cancer. Using high-tech treatment planning software, your treatment team controls the size and shape of the beam, as well as how it is directed at your body, to effectively treat your tumor while sparing the surrounding normal tissue.

Several special types of external beam therapy are discussed in the next sections. These are used for specific types of cancer, and your radiation oncologist will recommend one of these treatments if he or she believes it will help you.

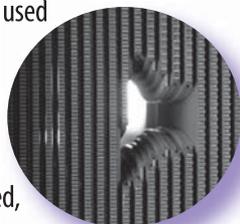
### THREE-DIMENSIONAL CONFORMAL RADIATION THERAPY (3D-CRT)

Tumors are not regular — they come in different shapes and sizes.

**Three-dimensional conformal radiation therapy**, or **3D-CRT**, uses computers and special imaging techniques to show the size, shape and location of the tumor.

Computer assisted tomography (**CT** or **CAT scans**), magnetic resonance imaging (**MR** or **MRI scans**) and/or positron emission tomography (**PET scans**) are used

to create detailed, three-dimensional representations of the tumor and surrounding organs. Your radiation oncologist can then precisely tailor the radiation beams to the size and shape of your tumor with **multileaf collimators** (see picture, right) or custom fabricated field shaping **blocks**. Because the radiation beams are very precisely directed, nearby normal tissue receives less radiation and is able to heal quickly.



### INTENSITY MODULATED RADIATION THERAPY (IMRT)

**Intensity modulated radiation therapy**, or **IMRT**, is a specialized form of 3D-CRT that allows radiation to be more exactly shaped to fit the tumor. With IMRT, the radiation beam can be broken up into many “beamlets,” and the intensity of each beamlet can be adjusted individually. Using IMRT, it may be possible to further limit

the amount of radiation that is received by healthy tissue near the tumor. In some situations, this may also allow a higher dose of radiation to be delivered to the tumor, potentially increasing the chance of a cure.

### PROTON BEAM THERAPY

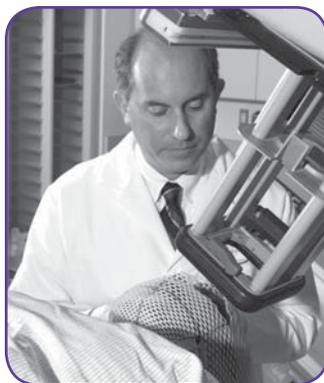
**Proton beam therapy** is a form of external beam radiation treatment that uses protons rather than X-rays to treat certain types of cancer and other diseases. The physical characteristics of the proton therapy beam allow doctors to more effectively reduce the radiation dose to nearby healthy tissue. Proton therapy is available at only a few specialized centers in the country.

### NEUTRON BEAM THERAPY

Like proton therapy, **neutron beam therapy** is a specialized form of external beam radiation therapy. It is often used to treat certain tumors that are **radioresistant**, meaning that they are very difficult to kill using conventional X-ray radiation therapy. Neutrons have a greater biologic impact on cells than other types of radiation. Used carefully, this added impact can be an advantage in certain situations. Neutron therapy is available at only a few specialized centers.

### STEREOTACTIC RADIO THERAPY

**Stereotactic radiotherapy** is a technique that allows your radiation oncologist to precisely focus beams of radiation to destroy certain types of tumors. Since the beam is so precise, your radiation oncologist may be able to spare more healthy tissue. This additional precision is achieved by using a very secure immobilization, such as a head frame used in the treatment of brain tumors. Stereotactic radiotherapy is frequently given in a single dose (sometimes called **radiosurgery**) although certain situations may require more than one dose. In addition to treating some cancers, radiosurgery can also be used to treat malformations in the brain's blood vessels and certain noncancerous (benign) neurologic conditions.



Sometimes a high dose of stereotactic radiotherapy can be focused upon a tumor outside the brain and given in a few treatments (typically three to eight). This form of treatment is called **stereotactic body radiation therapy**.

## IMAGE-GUIDED RADIATION THERAPY (IGRT)

Radiation oncologists use **image-guided radiation therapy**, or **IGRT**, to help better deliver the radiation to the cancer since tumors can move between treatments due to differences in organ filling or movements while breathing. IGRT involves conformal radiation treatment guided by imaging, such as CT, ultrasound or X-rays, taken in the treatment room just before the patient is given the radiation treatment. All patients first undergo a CT scan as part of the planning process. The imaging information from the CT scan is then transmitted to a computer in the treatment room to allow doctors to compare the earlier image with the images taken just before treatment. During IGRT, doctors compare these images to see if the treatment needs to be adjusted. This allows doctors to better target the cancer while avoiding nearby healthy tissue. In some cases, doctors will implant a tiny marker in or near the tumor to pinpoint it for IGRT.

## ● ● ● BRACHYTHERAPY

Also known as internal radiation, **brachytherapy** involves placing radioactive material into a tumor or its surrounding tissue. Because the radiation sources are placed so close to the tumor, your radiation oncologist can deliver a large dose of radiation directly to the cancer cells.



The radioactive sources used in brachytherapy, such as thin wires, ribbons, capsules or seeds, come in small sealed containers. These sources may be implanted permanently or temporarily. A permanent implant remains in the body after the sources are no longer radioactive. Other radioactive sources are placed temporarily inside the body and are removed after the right amount of radiation has been delivered.



## DID YOU KNOW?

Before you receive radiation therapy, your radiation

oncologist, dosimetrist and medical physicist work together using sophisticated computer software to calculate the best treatment for your body. This treatment planning ensures that the tumor site receives the maximum amount of radiation while minimizing exposure to healthy tissue and organs.

### SYSTEMIC RADIATION THERAPY

Certain cancers may be treated by swallowing radioactive pills or receiving radioactive fluids in the vein (intravenous). This type of treatment is called **systemic radiation therapy** because the medicine goes to the entire body. For example, radioactive iodine (I-131) capsules are given to treat some types of thyroid cancer. Another example is the use of intravenous radioactive material to treat pain due to cancer that has spread to the bone. **Radiolabeled antibodies** are **monoclonal antibodies** with radioactive particles attached. These antibodies are designed to attach themselves directly to the cancer cell and damage it with small amounts of radiation.

### NOVEL TARGETED THERAPIES

Cancer doctors now know much more about how cancer cells function. New cancer therapies use this information to target cancer cell functions and stop them. Called **targeted therapies**, they can be more specific in stopping cancer cells from growing and may make other treatments work better. For example, some medicines work to prevent cancers from growing by preventing the growth of new blood vessels that would nourish the cancer.

Other targeted therapies work more directly on cancer cells by blocking the action of molecules on the surface of cancer cells called growth factors.

### RADIOSENSITIZERS

Any drug that can make tumor cells more sensitive to radiation is called a **radiosensitizer**. Combining radiation with radiosensitizers may allow doctors to kill more tumor cells. Some types of chemotherapy and some novel targeted therapies can act as radiosensitizers.

### RADIOPROTECTORS

Some medicines called **radioprotectors** can help protect healthy tissue from the effects of radiation.

### INTRAOPERATIVE RADIATION THERAPY

Radiation therapy given during surgery is called **intraoperative radiation therapy**. Intraoperative radiation therapy is helpful when vital normal organs are too close to the tumor. During an operation, a surgeon temporarily moves the normal organs out of the way so radiation can be applied directly to the tumor. This allows your radiation oncologist to avoid exposing those organs to radiation. Intraoperative radiation can be given as external beam therapy or as brachytherapy.

## CHEMOTHERAPY

Medicines prescribed by a medical oncologist that can kill cancer cells directly are called chemotherapy. Some are given in pill form, and some are given by injection. Chemotherapy can also be considered a type of systemic therapy, because medicines go through the bloodstream to the entire body.

## IMMUNOTHERAPY

Some treatments are designed to help your own body's immune system fight the cancer, similar to how your body fights off infections.

## ● ● ● WHO ARE THE MEMBERS OF THE RADIATION THERAPY TEAM?

A team of highly trained medical professionals will be involved in your care during radiation therapy. This team is led by a radiation oncologist, a doctor who specializes in using radiation to treat cancer.

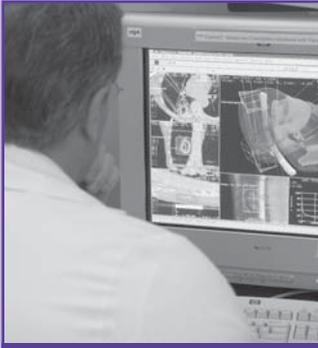
## RADIATION ONCOLOGISTS

Radiation oncologists are the doctors who will oversee your radiation therapy treatments. These physicians work with the other members of the radiation therapy team to develop and prescribe your treatment plan and make sure that each treatment is given accurately. Your radiation oncologist will also track your progress and adjust the treatment as necessary to make sure you receive the best care. Radiation oncologists help identify and treat any side effects that may occur due to radiation therapy. They work closely with other cancer doctors, including medical oncologists and surgeons, and all members of the radiation oncology team.



**RADIATION ONCOLOGISTS ARE THE DOCTORS WHO WILL OVERSEE YOUR RADIATION THERAPY TREATMENTS.**

Radiation oncologists have completed at least four years of college, four years of medical school, one year of general medical training and four years of residency (specialty) training in radiation oncology. They have extensive training in cancer medicine and the safe use of radiation to treat disease. If they pass a special examination, they are certified by the American Board of Radiology. You should ask if your doctor is board certified.



DOSIMETRISTS CAREFULLY  
CALCULATE THE DOSE OF RADIATION.

## MEDICAL PHYSICISTS

Medical physicists work directly with the radiation oncologist during treatment planning and delivery. They oversee the work of the dosimetrist and help ensure that complex treatments are properly tailored for each patient. Medical physicists develop and direct quality control programs for equipment and procedures. They also make sure the equipment works properly by taking precise measurements of the radiation beam and performing other safety tests on a regular basis.



RADIATION THERAPISTS  
ADMINISTER THE DAILY  
RADIATION TREATMENT.

## DOSIMETRISTS

Dosimetrists work with the radiation oncologist and medical physicist to carefully calculate the dose of radiation to make sure the tumor gets enough radiation. Using computers, they develop a treatment plan that can best destroy the tumor while sparing the healthy tissue.

## RADIATION THERAPISTS

Radiation therapists work with radiation oncologists to give the daily radiation treatment under the doctor's prescription and supervision. They maintain daily records and regularly check the treatment machines to make sure they are working properly.



RADIATION ONCOLOGY NURSES  
WILL CARE FOR YOU THROUGHOUT  
THE TREATMENT PROCESS.

## RADIATION ONCOLOGY NURSES

Radiation oncology nurses work with every member of the treatment team to care for you and your family before, during and after treatment. They will explain the possible side effects you may experience and will describe how you can manage them. They will assess how you are doing throughout treatment and will help you cope with the changes you are experiencing. If they pass a special exam, they are certified by the Oncology Nursing Exam as an Oncology Certified Nurse.

## OTHER HEALTHCARE PROFESSIONALS

You may work with a number of other healthcare professionals while undergoing radiation therapy. These specialists ensure that all of your physical and psychological needs are met during your treatment.

### SOCIAL WORKERS

Social workers are available to provide a variety of support services to you and your family. They can provide counseling to help you and your family cope with the diagnosis of cancer and with your treatment. They may also help arrange for home healthcare and other services.

### NUTRITIONISTS

Nutritionists, also called dietitians, can help you maintain your weight during treatment. They will help you modify your eating plan if the side effects of treatment are affecting your appetite, will determine what you can eat and can provide recipes, menu suggestions and information on ready-to-use nutritional supplements.

### PHYSICAL THERAPISTS

Physical therapists use exercises to help your body function properly while you are undergoing treatment. These exercises can help manage side effects, alleviate pain and keep you healthy.

### DENTISTS

Dentists may be involved if you are receiving radiation for oral or head and neck cancers. They will help prevent the radiation from damaging the healthy areas of your mouth, caring for teeth, gums and other tissues in the mouth, and may recommend preventive dental work before radiation. They will also help manage oral side effects of cancer therapy, such as dry mouth.

## ● ● ● IS RADIATION THERAPY SAFE?

Some patients are concerned about the safety of radiation therapy. Radiation has been used successfully to treat patients for more than 100 years. In that time, many advances have been made to ensure that radiation therapy is safe and effective.

Before you begin receiving radiation therapy, your radiation oncology team will carefully tailor your plan to make sure that you receive safe and accurate treatment. Treatment will be carefully planned to focus on the cancer while avoiding healthy organs in the area. Throughout your treatment, members of your team check and re-check your plan. Special computers are also used to monitor and double-check the treatment machines to make sure that the proper treatment is given.

If you undergo external beam radiation therapy, you will not be radioactive after treatment ends because the radiation does not stay in your body. However, if you undergo

brachytherapy, tiny radioactive sources will be implanted inside your body, in the tumor or in the tissue surrounding the tumor, either temporarily or permanently. Your radiation oncologist will explain any special precautions that you or your family and friends may need to take.

Some patients worry that radiation therapy will cause cancer years after treatment. While this is a very small risk, it is most important to cure the cancer now. Talk with your radiation oncologist or radiation oncology nurse about any fears you may have. Like all therapies, radiation can cause side effects. See page 17 for more information.

## WHAT HAPPENS BEFORE, DURING AND AFTER TREATMENT?

Once the diagnosis has been made, you will probably talk with your primary care physician along with several cancer specialists, such as a surgeon, a medical oncologist and a radiation oncologist, to discuss your treatment choices. These specialists will work together to help recommend the best treatment for you.

In some cases, your cancer will need to be treated by using more than one type of treatment. For example, if you have breast cancer, you might have surgery to remove the tumor (by a surgeon), then have radiation therapy to destroy any remaining cancer cells in or near your breast (by a radiation oncologist). You also might receive chemotherapy (by a medical oncologist) to destroy cancer cells that have traveled to other parts of the body.

### ● ● ● BEFORE TREATMENT

#### MEETING WITH A RADIATION ONCOLOGIST

If you are considering radiation therapy, you must first meet with a radiation oncologist to see if radiation therapy is right for you. During your first visit, your doctor will evaluate your need for radiation therapy and its likely results. This includes reviewing your current medical problems, past medical history, past surgical history, family history, medications, allergies and lifestyle. The doctor will also perform a physical exam to assess the extent of your disease and judge your general physical condition. You may also be seen by a medical student, a resident (radiation oncologist in training), a nurse practitioner, a physician's assistant or a nurse.



After reviewing your medical tests, including CT scans, MRI scans and PET scans, and completing a thorough examination, your radiation oncologist will discuss with you the potential benefits and risks of radiation therapy and answer your questions. For a list of questions that you may want to ask, please see the section ‘What Questions Should I Ask My Doctor?’ on page 20.

## **SIMULATION**

To be most effective, radiation therapy must be aimed precisely at the same target or targets each and every time treatment is given. The process of measuring your body and marking your skin to help your team direct the beams of radiation safely and exactly to their intended locations is called **simulation**.

During simulation, your radiation oncologist and radiation therapist place you on the simulation machine in the exact position you will be in during the actual treatment. Your radiation therapist, under your doctor’s supervision, then marks the area to be treated directly on your skin or on **immobilization devices**. Immobilization devices are molds, casts, headrests or other devices that help you remain in the same position during the entire treatment. The radiation therapist marks your skin and/or the immobilization devices either with a bright, temporary paint or a set of small, permanent tattoos.

Your radiation oncologist may request that special blocks or shields be made for you. These blocks or shields are put in the external beam therapy machine before each of your treatments and are used to shape the radiation to your tumor and keep the rays from hitting normal tissue. Multileaf collimators may also be used to shape the beam and achieve safe delivery of your radiation treatment.

## **TREATMENT PLANNING**

Once you have finished with the simulation, your radiation oncologist and other members of the treatment team review the information they obtained during simulation along with your previous medical tests to develop a **treatment plan**. Often, a special treatment planning **CT scan** is done to help with the simulation and treatment planning. This CT scan is in addition to your diagnostic CT scan. Frequently, sophisticated treatment-planning computer software is used to help design the best possible treatment plan. After reviewing all of this information, your doctor will write a prescription that outlines exactly how much radiation you will receive and to what parts of your body.

## EXTERNAL BEAM RADIATION THERAPY TREATMENTS

When you undergo external beam radiation therapy treatment, each session is painless, just like getting an X-ray. The radiation is directed at your tumor from a machine located away from your body, usually a linear accelerator. External beam radiation is noninvasive, unlike surgery which is an invasive process. One of the benefits of radiation therapy is that it is usually given as a series of outpatient treatments (meaning you don't have to stay in the hospital). You may not need to miss work or experience the type of recuperation period that may follow other treatments.

Treatments are usually scheduled five days a week, Monday through Friday, and continue for one to 10 weeks. The number of radiation treatments you will need depends on the size, location and type of cancer you have, the intent of the treatment, your general health and other medical treatments you may be receiving.

The radiation therapist will give you your external beam treatment following your radiation oncologist's instructions. It will take five to 15 minutes for you to be positioned for treatment and for the equipment to be set up. If an **immobilization device** was made during simulation, it will be used during every treatment to make sure that you are in the exact same position every day.

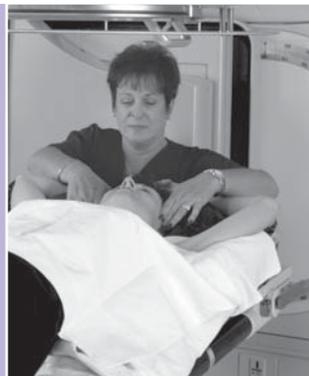
Once you are positioned correctly, the therapist will leave the room and go into the control room next door to closely monitor you on a television screen while giving the radiation. There is a microphone in the treatment room so you can always talk with the therapist if you have any concerns. The machine can be stopped at any time if you are feeling sick or uncomfortable.

The radiation therapist may move the treatment machine and treatment table to target the radiation beam to the exact area of the tumor. The machine might make noises during treatment that sound like clicking, knocking or whirring, but the radiation therapist is in complete control of the machine at all times.



### DID YOU KNOW?

Each external beam radiation treatment is painless and takes only a few minutes. Treatments are scheduled five days a week, every day except Saturday and Sunday, and continue for one to 10 weeks.



The radiation therapy team carefully aims the radiation in order to reduce the dose to the normal tissue surrounding the tumor. Still, radiation will affect some healthy cells. Time between daily treatments allows your healthy cells to repair much of the radiation effect, while cancer cells are not as likely to survive the changes.

Sometimes a course of treatment is interrupted for a day or more. This may happen if you develop side effects that require a break in treatment. These missed treatments may be made up by adding treatments at the end. Try to arrive on time and not miss any of your appointments. Time spent in the treatment room may vary depending on the type of radiation, but it generally ranges from 10 to 40 minutes. Most patients are treated on an outpatient basis, and many can continue with normal daily activities.

Your radiation oncologist monitors your daily treatment and may alter your radiation dose based on these observations. Also, your doctor may order blood tests, X-rays and other tests to see how your body is responding to treatment. If the tumor shrinks significantly, another simulation may be required. This allows your radiation oncologist to change the treatment to destroy the rest of the tumor and spare even more normal tissue.

## WEEKLY STATUS CHECKS

During radiation therapy, your radiation oncologist and nurse will see you regularly to follow your progress, evaluate whether you are having any side effects, recommend treatments for those side effects (such as medication), and address any concerns you may have. As treatment progresses, your doctor may make changes in the schedule or treatment plan depending on your response or reaction to the therapy.

Your radiation therapy team may gather on a regular basis with other healthcare professionals to review your case to ensure your treatment is proceeding as planned. During these sessions, all the members of the team discuss your progress as well as any concerns.

## WEEKLY BEAM FILMS

During your course of treatment, correct positions of the treatment beams will be regularly verified with images made using the treatment beam itself. These images (called port films, **beam films** or portal verification) represent an important quality assurance check, but do not evaluate the tumor itself.



YOUR TREATMENT TEAM REVIEWS YOUR PROGRESS AND CONFIRMS THE TREATMENT IS AIMED CORRECTLY.

## BRACHYTHERAPY

Brachytherapy is the placement of radioactive sources in or just next to a tumor. The word brachytherapy comes from the Greek “brachy” meaning short distance. During brachytherapy, the radioactive sources may be left in place permanently or only temporarily, depending upon your cancer. To position the sources accurately, special catheters or applicators are used.



BRACHYTHERAPY IS THE PLACEMENT OF RADIOACTIVE SOURCES IN OR JUST NEXT TO A TUMOR.

There are two main types of brachytherapy — **intracavitary treatment** and **interstitial treatment**. With intracavitary treatment, the radioactive sources are put into a space near where the tumor is located, such as the cervix, the vagina or the windpipe. With interstitial treatment, the radioactive sources are put directly into the tissues, such as the prostate.

Sometimes these procedures require anesthesia and a brief stay in the hospital. Patients with permanent implants may have a few restrictions at first and then can quickly return to their normal activities. Temporary implants are left inside of your body for several hours or days. While the sources are in place, you will stay in a private room. Doctors, nurses and other medical staff will continue to take care of you, but they will take special precautions to limit their exposure to radiation.

Devices called **high-dose-rate remote afterloading machines** allow radiation oncologists to complete brachytherapy quickly, in about 10 to 20 minutes. Powerful radioactive sources travel through small tubes called **catheters** to the tumor for the amount of time prescribed by your radiation oncologist. You may be able to go home shortly after the procedure. Depending on the area treated, you may receive several treatments over a number of days or weeks.

Most patients feel little discomfort during brachytherapy. If the radioactive source is held in place with an applicator, you may feel discomfort from the **applicator**. There are medications that can relieve this discomfort. If you feel weak or queasy from the anesthesia, your radiation oncologist can give you medication to make you feel better.

Depending on the type of brachytherapy you received, you may need to take some precautions after you leave your treatment, particularly if you plan to be around young children or pregnant women. Ask your radiation oncologist or radiation oncology nurse about anything special you should know.

## ● ● ● AFTER TREATMENT

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### FOLLOW UP

After treatment is completed, follow-up appointments will be scheduled so that your radiation oncologist can make sure your recovery is proceeding normally and can continue to monitor your health status. Your radiation oncologist may also order additional diagnostic tests. Reports on your treatment may also be sent to the other doctors helping treat your cancer.

As time goes by, the number of times you need to visit your radiation oncologist will decrease. However, you should know that your radiation oncology team will always be available should you need to speak to someone about your treatment.

## ● ● ● ARE THERE ANY SIDE EFFECTS?

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Radiation therapy is usually well tolerated and many patients are able to continue their normal routines. However, some patients may eventually develop painful side effects. Be sure to talk to a member of your radiation oncology treatment team about any problems or discomfort you may have.

Many of the side effects of radiation therapy are only in the area being treated. For example, a breast cancer patient may notice skin irritation, like a mild to moderate sunburn, while a patient with cancer in the mouth may have soreness when swallowing. Some patients who are having their midsection treated may report feeling sick to their stomach. These side effects are usually temporary and can be treated by your doctor or other members of the treatment team.

Side effects usually begin by the second or third week of treatment, and they may last for several weeks after the final radiation treatment. In rare instances, serious side effects develop after radiation therapy is finished. Your radiation oncologist and radiation oncology nurse are the best people to advise you about the side effects you may experience. Talk with them about any side effects you are having. They can give you information about how to manage them and may prescribe medicines or changes in your eating habits to help relieve your discomfort.

The side effect most often reported by patients receiving radiation is fatigue. The fatigue patients experience is usually not severe, and patients may be able to continue all or some of their normal daily activities with a reduced schedule. However, treating cancer often requires considerable mental and physical effort. Whenever possible, try to take time during your treatment to rest and relax.

Many patients are concerned that radiation therapy will cause another cancer. In fact, the risk of developing a second tumor because of radiation therapy is very low. For many patients, radiation therapy can cure your cancer. This benefit far outweighs the very small risk that the treatment could cause a later cancer. If you smoke, the most important thing you can do to reduce your risk of a second cancer is to quit smoking.

## ● ● ● WHAT ARE CLINICAL TRIALS?

Cancer specialists regularly conduct studies to test new treatments. These studies are called **clinical trials**. Clinical trials are available through cancer doctors everywhere — not just in major cities or in large hospitals.

Some clinical studies try to determine if a therapeutic approach is safe and potentially effective. Many large clinical trials compare the more commonly used treatment with a treatment that cancer experts think might be better. Patients who participate in clinical trials help doctors and future cancer patients find out whether a promising treatment is safe and effective. All patients who participate in clinical trials are carefully monitored to make sure they are getting quality care. It is important to remember that clinical trials are completely voluntary. Patients can leave a trial at any time.

Clinical trials testing new treatments are carried out in phases.

### **Phase I — Is the Treatment Safe?**

As the first step in testing the research, doctors gather information about the side effects of the treatment and decide on the safe dose. Only a few patients in a few places take part in a Phase I trial.

### **Phase II — Does the Treatment Work?**

In this step, doctors test the treatment to see how well it works. Most of the time, fewer than 100 patients are involved in Phase II trials.

### **Phase III — Is the Treatment Better?**

Phase III trials compare the new treatment against the current standard therapy and randomly assign patients into one of the two groups. Many people from all over the country take part in these trials.

### **Phase IV — Are There Better Ways to Use the Treatment?**

In this final step, treatments are tested to make sure they are safe and work well over a long period of time. This phase most often occurs once the new treatment has been approved for standard use. Anywhere from several hundred to several thousand people are enrolled in a Phase IV trial.

Only you can make the decision about whether or not to participate in a clinical trial. Before making your decision, it is important to learn as much as possible about your cancer and the clinical trials that may be available to you. Your radiation oncologist can answer many of your questions if you are considering taking part in a trial or contact the National Cancer Institute at 1-800-4-CANCER or [www.cancer.gov](http://www.cancer.gov).

## ● ● ● HOW SHOULD I CARE FOR MYSELF DURING RADIATION THERAPY?

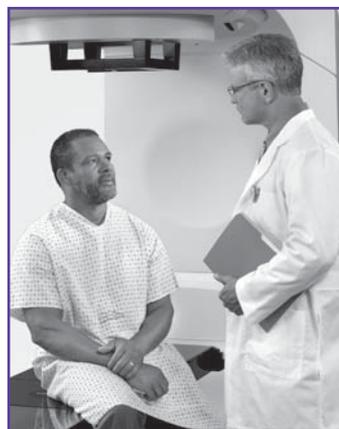
**Get plenty of rest.** Many patients experience fatigue during radiation therapy, so it is important to make sure you are well rested. If possible, ask friends and family to help out during treatment, by running errands and preparing meals. This will help you get the rest you need to focus on fighting your cancer.

**Follow doctor's orders.** In many cases, your doctor will ask you to call if you develop a fever of 101° or higher. Be sure to read your instructions as far as caring for yourself during treatment.

**Eat a balanced, nutritious diet.** A nutritionist, nurse or doctor may work with you to make sure you are eating the right foods to get the vitamins and minerals you need. With certain types of radiation, you may need to change your diet to minimize side effects. You should not attempt to lose weight during radiation therapy since you need more calories due to your cancer and treatment.

**Treat the skin that is exposed to radiation with extra care.** The skin in the area receiving treatment may become red and sensitive, similar to getting a sunburn. Your radiation oncology nurse will review specific instructions for caring for your skin with you. Some guidelines include:

- Clean the skin daily with warm water and a mild soap recommended by your nurse.
- Avoid using any lotions, perfumes, deodorants or powders in the treatment area unless approved by your doctor or nurse. Try not to use products containing alcohol and perfumes.
- Avoid putting anything hot or cold on the treated skin. This includes heating pads and ice packs.
- Stay out of the sun. If you must spend time outdoors, wear a hat or clothing to protect your skin. After treatment, use sunscreen with an SPF of at least 15.



**Seek out support.** There are many emotional demands that you must cope with during your cancer diagnosis and treatment. It is common to feel anxious, depressed, afraid or hopeless. It may help to talk about your feelings with a close friend, family member, nurse, social worker or psychologist. To find a support group in your area, ask your radiation oncology nurse. There are many support groups that meet in person, over the phone or on the Internet.

## ● ● ● WHAT QUESTIONS SHOULD I ASK MY DOCTOR?

Coping with a diagnosis of cancer and researching the various treatment options can be a stressful experience. To assist you in this process, below is a list of questions you may want to ask your radiation oncologist if you are considering radiation therapy.

### QUESTIONS TO ASK BEFORE TREATMENT

- What type and stage of cancer do I have?
- What is the purpose of radiation treatment for my type of cancer?
- How will the radiation therapy be given? Will it be external beam or brachytherapy? What do the treatments feel like?
- For how many weeks will I receive radiation? How many treatments will I receive per week?
- What are the chances that radiation therapy will work?
- Can I participate in a clinical trial? If so, what is the trial testing? What are my benefits and risks?
- What is the chance that the cancer will spread or come back if I do not have radiation therapy?
- Will I need chemotherapy, surgery or other treatments? If so, in what order will I receive these treatments? How soon after radiation therapy can I start them?
- How should I prepare for this financially?
- What are some of the support groups I can turn to during treatment?
- If I have questions after I leave here, who can I call?
- Will radiation therapy affect my ability to have children?
- Do you take my insurance?

### QUESTIONS TO ASK DURING TREATMENT

- How can I expect to feel during treatment and in the weeks following radiation therapy?
- Can I drive myself to and from the treatment facility?
- Will I be able to continue my normal activities?
- What side effects may occur from the radiation and how are they managed?
- Do I need a special diet during or after my treatment?
- Can I exercise?
- Can I have sex?
- Can I smoke or drink alcohol?
- Will side effects change my appearance? If so, will the changes be permanent or temporary? If temporary, how long will they last?
- Is it safe to take vitamins during treatment?

### QUESTIONS TO ASK AFTER TREATMENT ENDS

- How and when will you know if I am cured of cancer?
- What are the chances that the cancer will come back?
- How soon can I go back to my regular activities? Work? Sexual activity? Aerobic exercise?
- How often do I need to return for checkups?

**Adjuvant therapy:** A treatment that is given in addition to the primary treatment to enhance its effectiveness and reduce the chance of the tumor recurring.

**Applicator:** A device used to hold a radioactive source in place during brachytherapy.

**Beam films:** Another term for port films, beam films are pictures of the position of the radiation beams used to treat cancer. They are used to verify the position of the beams and confirm that treatment is delivered to the right place.

**Biologic therapy:** Also called immunotherapy, biologic therapy works with your immune system to fight cancer. Biologic therapy is like chemotherapy. The difference is that chemotherapy attacks the cancer directly and biologic therapy helps your immune system fight the disease better.

**Blocks:** Pieces of metal alloy that can be used to shape the radiation beam.

**Boost:** An additional dose of radiation that is given after an initial course of radiation to enhance tumor control.

**Brachytherapy or implant:** Internal radiation therapy that involves placing radioactive sources inside or adjacent to the tumor.

**Cancer:** A group of diseases in which abnormal cells divide uncontrollably, forming a tumor or mass.

**Catheter:** A tube inserted into the body that can be used to deliver radiation during brachytherapy.

**Chemotherapy:** Medications given to kill or slow the growth of cancer cells.

**Clinical trials:** Studies that test new cancer therapies.

**CT or CAT scan:** A computer assisted tomography scan is an imaging study that uses X-rays and a computer to produce detailed pictures of the body.

**High-dose-rate remote afterloading or HDR:** A brachytherapy treatment delivering radiation with a small, intense radioactive source on the tip of a flexible wire inserted into hollow tubes placed into or near a tumor by a radiation oncologist.

**Hormone therapy:** Natural hormones, such as estrogen and testosterone, help some tumors grow. To stop their growth, doctors sometimes prescribe hormone therapy to reduce the amount of hormones produced by the body in order to stop the growth of the cancer.

**Hyperfractionated radiation therapy:** A type of radiation therapy in which the radiation doses are divided into smaller amounts and patients undergo treatment more than once a day.

**Hypofractionated radiation therapy:** A type of radiation therapy in which patients undergo one or just a few treatments.

**Image-guided radiation therapy or IGRT:** A radiation treatment guided by imaging equipment, such as CT, ultrasound or X-rays, taken in the treatment room just before radiation is given. During IGRT, doctors compare these images to see if the treatment needs to be changed.

**Immobilization device:** A device that is used to help a patient remain in the same position during every treatment.

**Immunotherapy:** Also called biologic therapy, immunotherapy works with your immune system to fight cancer.

**Implant:** See brachytherapy on page 21.

**Intensity modulated radiation therapy or IMRT:** IMRT is a specialized form of external beam therapy that can help improve how the radiation is shaped to fit your tumor.

**Interstitial brachytherapy:** A form of seed implant where radioactive sources are placed directly into the tumor (such as the prostate).

**Intracavitary brachytherapy:** A type of brachytherapy where the radioactive sources are placed into a space where the tumor is located, such as the cervix or windpipe.

**Irradiation:** The process of treating a patient with radiation therapy.

**Linear accelerator or linac:** The most common type of machine used to deliver external radiation therapy.

**Medical oncologist:** A cancer doctor who specializes in giving drugs (called chemotherapy or targeted agents) to kill cancer cells or slow down their growth.

**Metastases:** Cancer that has spread from one part of the body to another, such as from the breast to the lymph nodes or bones.

**Monoclonal antibodies:** Monoclonal antibodies target certain cells in the body by attaching themselves to those molecules. This causes some cancer cells to die and makes other cells more likely to be killed by radiation and chemotherapy.

**MR or MRI scan:** A magnetic resonance imaging scan is an imaging study that uses a magnetic field and a computer to create detailed pictures of the body.

**Multileaf collimator or MLC:** A part of a linear accelerator that is used to shape the radiation beam.

**Neutron beam therapy:** A specialized type of external beam radiation therapy using neutrons to treat tumors.

**Palliative care or palliation:** Treatment that is intended to relieve symptoms, but not cure disease.

**PET scan:** A positron emission tomography scan is an imaging study using a very small dose of a radioactive tracer attached to a sugar that is injected into the patient. Different tissues (including tumors) use the sugar at different rates, a characteristic that may be detected by the scanner to create an image of the body showing areas of tumor activity.

**Proton beam therapy:** A specialized type of external beam radiation therapy using protons to treat tumors.

**Radiation oncologist:** A doctor who specializes in treating cancer and other diseases with radiation therapy.

**Radiation therapy:** Also called radiotherapy or irradiation, it is the careful use of various forms of radiation to treat cancer and other diseases.

**Radioimmunotherapy:** The use of radiolabeled antibodies to deliver radiation directly to a tumor.

**Radiolabeled antibodies:** Monoclonal antibodies that have had a radioactive isotope attached to them in a process called radiolabeling.

**Radioprotector:** A type of drug that protects normal tissues in the area being treated.

**Radioresistant:** A term used to describe a tumor that does not respond well to radiation therapy.

**Radiosensitizer:** A type of drug that can make a tumor respond better to radiation therapy.

**Radiotherapy:** Also called radiation therapy or irradiation, it is the careful use of various forms of radiation to treat cancer and other diseases.

**Simulation:** The process of planning radiation therapy to allow the radiation to be delivered to the intended location.

**Stereotactic radiotherapy:** A technique that allows your radiation oncologist to precisely focus beams of radiation to destroy certain types of tumors. It is sometimes called radiosurgery.

**Surgical oncologist:** A cancer doctor who specializes in operating to cut out cancerous tumors.

**Systemic radiation therapy:** The use of radioactive isotopes that can travel throughout the body to treat certain cancers.

**Treatment plan:** A radiation oncologist's prescription describing how a patient should be treated with radiation therapy. The radiation oncology team uses special software to maximize radiation to the tumor while sparing healthy tissue.

**Tumor:** An abnormal lump or mass of tissue.



If you have any questions about your diagnosis, treatment or side effects, please contact your doctor or other members of your treatment team. To locate a radiation oncologist in your area, or for additional cancer treatment information, please visit [www.ranswers.org](http://www.ranswers.org).

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