

RADIATION THERAPY FOR CANCER



Your Partners in Cancer Treatment

ASTRO

TARGETING CANCER CARE

AMERICAN SOCIETY FOR RADIATION ONCOLOGY

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Remember, your radiation oncologist, radiation therapist and radiation oncology nurse are the best people to make recommendations and answer questions about radiation treatments.

Introduction

This booklet was written for people who want to know more about radiation therapy as a treatment option. Radiation, either alone or in combination with other cancer therapies, can be used to successfully treat many different types of cancer. Finding out that you have cancer may lead to a flood of feelings and concerns. Learning about your disease and ways to treat it can be overwhelming and confusing. As you prepare for treatment, it may be helpful to learn as much as you can about your treatment options and what you may experience. Radiation therapy techniques and procedures may vary among different doctors, hospitals and treatment centers. Be sure to ask questions if the advice of your doctor is different from what you read here, find on the Internet, see in other publications or hear on the news. Your care is individually tailored for you by your team. There is no way to fully describe the many combinations of therapies given to patients in this type of brochure. Rather, some general themes and principles are provided for your information.

Cancer doctors can treat cancer with radiation therapy, surgery or medications, including chemotherapy, hormonal therapy and biologic therapy, either alone or in combination. If your cancer can be treated with radiation therapy, you will be seen by 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 surgical and medical oncologists, to oversee your care. He or she will discuss with you the details of your cancer, the role of radiation therapy in your overall treatment plan and what to expect from your treatment.



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 therapy works by damaging the genetic material within cancer cells. Once this happens, the cancer cells are not able to grow and spread. When these damaged cancer cells die, the body naturally removes them. Normal cells are also affected by radiation, but they are able to repair themselves in a way that cancer cells cannot. Your radiation oncologist will develop a plan to deliver the radiation to the tumor area, shielding as much surrounding normal tissue as possible.

Your radiation oncologist may recommend using radiation therapy in a number of different ways. Often, the goal is to **cure** the cancer. In this case, radiation therapy may be used to:

- Eliminate 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 cancer cells that might remain.
- Shrink the tumor before surgery.

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

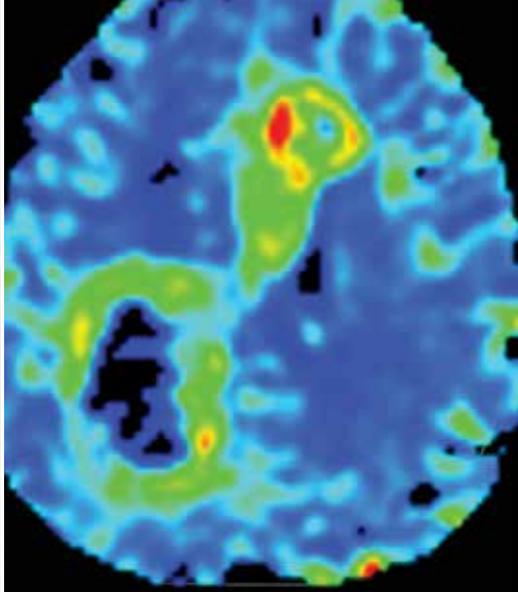
- Shrink tumors that are harming your quality of life, such as a lung tumor that is causing problems with breathing.
- Relieve pain by reducing the size of a tumor.

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

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.





WHAT ARE THE DIFFERENT KINDS OF RADIATION?

The goal of radiation therapy is to deliver enough radiation 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 decide which treatments are best for you.

Radiation therapy can generally be delivered in three ways:

1. **External beam radiation therapy:** The treatment team uses a machine outside the body to direct radiation beams such as high-energy X-rays at the cancer.
2. **Brachytherapy:** This involves placing radioactive sources (for example, radioactive seeds) in or near the tumor.
3. **Systemic radiation therapy:** Radioactive drugs are given to the patient and travel through the bloodstream to treat cancer throughout the body.

EXTERNAL BEAM RADIATION THERAPY

During external beam radiation therapy, a beam (or multiple beams) of radiation is directed through the skin to the cancer and the immediate surrounding area to destroy the 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 enough radiation to get into your body to kill the cancer while giving healthy cells time to recover.

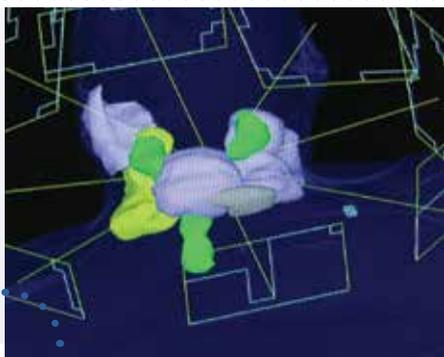
The radiation beam is usually generated by a machine called a **linear accelerator**, or **linac**. The linear accelerator is able to produce high-energy X-rays or electrons for the treatment of your cancer. Using treatment planning computers and software, your treatment team controls the size and shape 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, used for specific types of cancer, are discussed in the next sections.

Three-Dimensional Conformal Radiation Therapy (3-D CRT)

Tumors are not all the same; they come in different shapes and sizes. Also, every patient's body is unique. **Three-dimensional conformal radiation therapy** uses computers and special imaging techniques such as **CT**, **MR** or **PET** scans to show the size, shape and location of the tumor as well as surrounding organs. Your radiation oncologist can then precisely tailor the radiation beams to the size and shape of your tumor with special shielding. Because the radiation beams are carefully targeted, nearby normal tissue receives less radiation and is able to heal better.

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.





Intensity Modulated Radiation Therapy (IMRT)

Intensity modulated radiation therapy is a specialized form of 3-D CRT that allows radiation to be specifically shaped to cover the tumor and spare more normal tissue. 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 received by healthy tissue near the tumor. In some situations, this may also safely allow a higher dose of radiation to be delivered to the tumor.

Image Guided Radiation Therapy (IGRT)

Radiation oncologists use **image guided radiation therapy** to more accurately deliver radiation to the cancer. 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 on a daily basis. Because tumors can move between treatments, due to differences in organ filling or movements while breathing, IGRT allows for better targeting of cancer cells. You will first undergo a CT scan as part of the planning process. The information from the CT scan is then transmitted to a computer in the treatment room to allow the team to compare the earlier image with the images taken just before treatment. During IGRT, the team compares these images to see if the treatment needs to be adjusted. In some cases, doctors will implant a tiny marker in or near the tumor to help localize the treatment area. IGRT allows the team to better target the cancer while avoiding nearby healthy tissue.

Stereotactic Radiation Therapy

Stereotactic radiotherapy is a specialized technique that allows your radiation oncologist to use extremely focused beams of radiation to destroy certain types of tumors using higher doses than with daily radiation treatments. Since the beam is so precise, your radiation oncologist may be able to spare more healthy tissue. In selected cases, stereotactic treatments can be used to retreat tumors that have received radiation before.

Stereotactic radiotherapy was first developed to treat brain tumors in a single dose, sometimes called **stereotactic radiosurgery** or **SRS**. In addition to treating cancers, radiosurgery can also be used to treat benign tumors and certain noncancerous neurologic conditions. In some cases, using more than a single dose may help decrease the risk of side effects with stereotactic radiation therapy.



Treatment outside the brain is called **stereotactic body radiation therapy (SBRT)**. It is typically given in a few treatments. Often used for the lung, spine or liver, SBRT may allow radiation to be given in a way that is safer and more effective than other radiation techniques.

Because specialized treatments with stereotactic radiation are often much higher doses than daily radiation treatment, additional precision and quality assurance is necessary. This involves using very secure immobilization of the head or body as well as using techniques that allow the radiation beam to account for organ motion during treatment. Stereotactic radiation offers new ways for your doctor to treat cancer. In many clinics, these technologies are called by the name of the vendor that makes it or the product name. Visit www.rtnswers.org/SBRT to see a current list of brand names.

Intraoperative Radiation Therapy

Radiation therapy given during surgery is called **intraoperative radiation therapy**, which can be helpful when vital normal organs are very 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.

Proton Beam Therapy

Proton beam therapy is a form of external beam radiation treatment that uses protons rather than electrons or X-rays to treat certain types of cancer and other diseases. The physical properties of the proton therapy beam allow the radiation oncologist to more effectively reduce the radiation dose to nearby healthy tissue.

Neutron Beam Therapy

Like proton therapy, **neutron beam therapy** is a specialized form of external beam radiation therapy. It involves using neutrons rather than electrons or X-rays to treat certain types of cancer. It is often used to treat certain tumors that are **radioresistant**, meaning 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 centers in the country.

BRACHYTHERAPY

Brachytherapy is the placement of radioactive sources in or just next to a tumor. During brachytherapy, the radioactive sources may be left in place permanently or only temporarily, depending upon your cancer.

There are two main forms 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. Another use of brachytherapy is surface mold brachytherapy, which can be used externally to treat some skin cancers.

Depending on the technique, radiation therapy dose from brachytherapy can be delivered with one of two different dose rates – **high-dose-rate (HDR)** or **low-dose-rate (LDR)**. With HDR brachytherapy, radiation dose is deposited at a faster rate. LDR brachytherapy emits radiation at a slower rate.

HDR brachytherapy involves the temporary placement of a powerful radiation source, accurately directed by your radiation oncologist and team. It is delivered into the tumor through a tube called a catheter. It is usually given in multiple doses once or twice daily or once or twice weekly. This procedure may require anesthesia and a surgical procedure. Your doctor and team will control this treatment from outside the treatment room, monitoring you as the therapy is being given. Devices

Did You Know?

Whether you receive external beam radiation therapy or brachytherapy, your treatment schedule may vary. Although it is often given as a daily treatment Monday to Friday, radiation therapy may be given in different doses. In selected cases, radiation treatments are given in smaller doses twice a day or higher doses less than every day. These different schedules are designed to improve tumor control, lessen side effects or both.





called high-dose-rate remote afterloading machines allow the team to deliver treatments quickly. You may be able to go home shortly after the procedure, resuming your normal activities with few restrictions.

LDR brachytherapy involves the placement of temporary or permanent radiation sources into the tumor area. Placement of permanent radiation sources often require anesthesia, a surgical procedure 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 the body for minutes, hours or days, depending on the type of brachytherapy. While the temporary radioactive sources are in place, patients stay in a private room. During this period, doctors, nurses and other medical staff will continue to take care of patients, but they will take special precautions to limit their exposure to radiation. Once the temporary implants are removed, these patients have few restrictions and can quickly return to their regular routine.

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, ask your team for medication to help you feel better.

Depending on the type of brachytherapy you receive, you may need to take some precautions after you leave your treatment, particularly if you plan to be around young children or pregnant women. Because temporary implants are removed after treatment, these radiation safety precautions apply mainly with permanent implants. Ask your radiation oncologist or radiation oncology nurse about anything special you should know. Brachytherapy may be used alone or in combination with external radiation treatments. Your radiation oncologist will advise you if these treatments are appropriate for you.

SYSTEMIC RADIATION THERAPY

Certain cancers may be treated with radioactive drugs that spread throughout the body via the bloodstream. These treatments may be delivered 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.

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 situation. This treatment planning ensures that the tumor site receives the maximum amount of radiation while minimizing exposure to healthy tissue and organs.



WHAT ARE THE SIDE EFFECTS OF RADIATION THERAPY?

Most of the side effects of radiation therapy are limited to the area being treated. Short-term side effects are related to injury to normal rapidly dividing cells.

They are usually temporary, mild and treatable. These symptoms typically begin by the second or third week of

treatment. They may last for a few weeks after the final radiation treatment and typically go away one month after completing radiation therapy. For example, a breast cancer patient may notice skin irritation on the chest, like a mild to moderate sunburn, while a patient with cancer in the mouth may have soreness when swallowing.



The short-term side effect most often reported by patients receiving radiation therapy is fatigue. The fatigue experienced is usually mild or moderate and differs for each patient. Fatigue may also be related to the area being treated and other therapies, such as chemotherapy, that the patient may be receiving. Patients may be able to continue all or a portion of their normal daily activities. However, receiving treatment for cancer often requires considerable mental and physical effort. Whenever possible, try to take time during your treatment to rest and relax. If you experience discomfort or other symptoms during or after treatment, be sure to tell your radiation oncology team. They may be able to recommend strategies, prescribe medication or suggest changes to your diet to help.

Long-term side effects of radiation therapy may occur in any normal tissues in the irradiated area. With careful radiation therapy planning using improved technologies, serious long-term side effects are uncommon. The risks of long-term side effects depend on the area receiving radiation as well as the radiation dose being given. It is best to discuss the specific risks of long-term side effects with your radiation oncologist.

Some patients are concerned that radiation therapy will cause another cancer in the long-term. In fact, the risk of developing a second tumor because of radiation therapy is extremely low. For many people, the benefits of radiation therapy outweigh any small risk that the treatment

could cause a later cancer or other serious health conditions. However, you should discuss the risks and benefits of all of your treatments with your treatment team. If you smoke, the most important thing you can do to reduce your risk of a second cancer is to quit smoking.

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 your treatment plan and ensure that each treatment is given safely and accurately. Your radiation oncologist will also monitor your progress and adjust the treatment as necessary to make sure the radiation is hitting its target while minimizing side effects. Before, during and after your radiation therapy, your radiation oncologist works closely with other cancer doctors such as medical oncologists and surgeons to maximize radiation's effectiveness.

Radiation oncologists are the only physicians with the expertise and training to deliver radiation therapy treatments. In addition to college and medical school, five years of additional training are required for radiation oncologists. They receive extensive training in cancer medicine, in the use of radiation to treat disease and in managing any side effects caused by radiation. Radiation oncologists must pass an examination by the American Board of Radiology to become board certified.

Radiation Therapists

Radiation therapists work under the supervision of the radiation oncologist to give daily radiation treatments. They are experts at operating the radiation therapy machines (linacs) and require specialized training. They carefully and skillfully set up patients for their daily treatments.

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 explain the possible side effects you may experience and describe how you can manage them. They assess how you are doing throughout treatment and help you cope with the changes you are experiencing.

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 to ensure maximum treatment safety. They are trained with advanced degrees and are appropriately credentialed to provide this important service. These professionals make sure the equipment works properly by taking precise measurements of the radiation beam and performing other safety tests on a regular basis.



Dosimetrists

Dosimetrists work with the radiation oncologist and medical physicist to develop an optimized treatment plan that best destroys the tumor while sparing healthy tissue. They carefully calculate the dose of radiation to make sure the tumor gets the prescribed amount. These professionals require advanced training to create expert radiation plans.

Other members of the treatment team may include social workers, nutritionists, patient navigators, radiation engineers, physical therapists, radiation data managers and dentists. In cases where radiation is used in combination with chemotherapy or surgery, a coordinated multidisciplinary team often extends beyond the radiation treatment team to include health care professionals from medical oncology and surgery.



IS RADIATION THERAPY SAFE?

Some patients worry 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. With each advance, new quality checks have been developed to ensure safe treatment.

Before you begin receiving radiation therapy, your radiation oncology team will carefully design 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 recheck your plan through repeat imaging and radiation patient chart review. The team will meet with you at least weekly to assess your progress and monitor any unexpected side effects that are occurring. Special computers are also used to monitor and double-check the treatment machines to make sure that the proper treatment is given.

The medical physicist will work with the team to develop an extensive safety and quality assurance plan to ensure that every patient receives the correct treatment in the safest possible way, each and every time. Dosimetrists use advanced computerized systems to carefully measure the dose of radiation that patients receive to each critical area. Radiation therapists expertly deliver treatments using specialized protocols designed to enhance safety. Radiation oncologists oversee every step of the entire process, focusing on safe and effective treatment for every patient.



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 seeds may be implanted into your body either temporarily or permanently. Your radiation oncologist will explain any special precautions that you or your family may need to take for a short time following treatment to ensure the safety of those around you.

WHAT HAPPENS BEFORE, DURING AND AFTER TREATMENT?

Once a diagnosis of cancer 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. You will want to ask these doctors about all your treatment options. In many 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. After reviewing your medical record including imaging, as well as completing a thorough patient history and physical examination, your radiation oncologist will discuss with you the potential benefits and risks of radiation therapy and answer your questions.

BEFORE TREATMENT

If you are considering radiation therapy, you must first meet with a radiation oncologist. 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 along with your physician. During your first visit, your doctor will evaluate you to determine if radiation therapy will be helpful in treating your disease. This includes reviewing your current medical history, past medical history, past surgical history, family history, medications, allergies, lifestyle and current symptoms. The doctor will also perform a detailed physical exam to assess the extent of your disease and assess your general physical condition. Your medical record will be reviewed including any relevant imaging and laboratory studies. Frequently, your care will be discussed between a multidisciplinary group



of specialists including medical oncologists, surgeons, radiologists and pathologists to individualize treatment recommendations. The radiation oncologist will discuss the benefits, risks, side effects and treatment alternatives of radiation therapy with you and caregivers. If you decide to receive radiation therapy, you will proceed to treatment planning at the appropriate time.

Simulation

Radiation therapy must be aimed precisely at the treatment target each and every time treatment is given. The process of measuring your body and tumor to help your team direct the beams of radiation safely and accurately 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 maintain during the actual treatment. **Immobilization devices** such as molds, casts, headrests or other devices are customized to help you remain in the same position during the entire treatment. The radiation therapist, under the radiation oncologist's supervision, marks the area to be treated on the immobilization devices and/or your skin with either a bright, temporary paint or a set of small, permanent tattoos. Often, a special treatment planning CT scan is done to help with the treatment planning. This CT scan is in addition to prior diagnostic CT scans and helps with designing the placement and shape of the radiation beams. Your radiation oncologist may request that special blocks or shields be made for you. These devices are used with each treatment to direct the radiation to your tumor and keep the radiation away from normal tissue.

Treatment Planning

Once you have finished simulation, your radiation oncologist and other members of the treatment team review information obtained during simulation along with your previous medical tests to develop a **treatment plan**. The goal of radiation therapy is to develop a plan that maximizes the dose to the cancer and minimizes the dose to normal tissues. Radiation treatment technique, radiation dose, as well as beam angles and shapes will be selected during the planning process. A team of experts including your radiation oncologist, medical physicist and dosimetrist will work together to develop the radiation treatment plan. A sophisticated treatment-planning computer and associated software may be used to help design the best possible treatment plan. After reviewing all of this information, your radiation oncologist will write a prescription that outlines exactly how much radiation you will receive and to what parts of your body.

Quality Assurance Before Treatment

Once your radiation oncologist approves the radiation therapy plan developed in treatment planning, members of the radiation treatment team work together to ensure that your specific treatment plan works correctly on the linear accelerator before treatment begins. A 'dry run' is often completed for more complex treatments by a medical physicist to ensure that the radiation treatment designed for you is as accurate and as safe as possible.



DURING 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 therapy is noninvasive. One of the benefits of radiation therapy is that it is usually given as a series of outpatient treatments so you do not have to stay in the hospital. You may not need to miss work or experience the type of recuperation period that may follow more invasive treatments. The radiation therapists will deliver your external beam treatment following your radiation oncologist's instructions. 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. Radiation therapists position you for treatment and set-up the equipment. Time spent in the treatment room will vary depending on the type of radiation.

Once you are positioned correctly, the therapist will leave the treatment room and enter the control room next door to begin your treatment. During your treatment, your therapist will closely monitor you on a television screen. There is a microphone in the treatment room so you can always speak 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.

Your radiation oncologist monitors your daily treatment and may alter your radiation dose based on these observations. Also, your doctor may obtain other tests such as blood tests and imaging to see how your body is responding to treatment. If the tumor shrinks or if your body changes 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.

Sometimes a course of treatment may need to be interrupted for a day or more. This may happen if you develop side effects that require a break in treatment. Unscheduled machine maintenance may also cause a missed daily treatment. These missed treatments may be made up by adding treatments at the end. However, it is best to arrive on time and not miss any of your appointments.

Treatments are usually scheduled five days a week, Monday through Friday, and continue for multiple weeks. The number of radiation treatments you will need depends on the size, location and type of cancer you have, the goal of treatment, your general health and other medical treatments you may be receiving. Radiation oncologists will take all of this into account when determining your treatment course.

A portion of your external radiation therapy may be directed at the tumor and surrounding tissues at risk for harboring microscopic cancer cells. This might be followed by shrinkage of the volume of tissue treated to the

tumor area itself, since this area may require a higher dose to eliminate the cancer cells. This is called a boost.

In some cases, you may receive chemotherapy and radiation therapy at the same time. The chemotherapy may be delivered daily, weekly, every three weeks or at an alternate schedule determined by the medical oncologist together with the radiation oncologist. The chemotherapy may work to sensitize the cancer cells in the target area to the radiation therapy and may also travel elsewhere in the body to help destroy or reduce microscopic cancer cells. Your treatment team will help coordinate these therapies and care for potential side effects.



Weekly Checkups

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. Your doctor may also make changes in the schedule or treatment plan depending on your response or reaction to the therapy. Your radiation oncology team will gather on a regular basis with other health care 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 and any concerns.

Quality Assurance During Treatment

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. Depending upon what kind of treatment you receive and what your doctor thinks will work best, the type of images used (e.g., X-ray, CT scan, ultrasound, etc.) may vary. These images assure your radiation oncologist that the treatment set-up accurately matches the intended target.

AFTER TREATMENT 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. Your radiation oncologist, in concert with other members of your team, may order additional diagnostic tests. Reports on your treatment may be sent to the other doctors helping treat your cancer. Continued follow-up in the radiation oncology clinic is recommended to evaluate for long-term side effects of radiation therapy and to ensure that the cancer does not return. As time goes by, the number of times you need to visit your radiation oncologist throughout the year 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.

WHAT ARE CLINICAL TRIALS?

Cancer specialists regularly conduct studies to test new treatments. These studies are called clinical trials. Most standard cancer treatments are based on the results of previous **clinical trials**. Clinical trials are available through cancer doctors everywhere — not just in major cities, university centers or in large hospitals.

Some clinical trials try to determine if a therapeutic approach is safe and potentially effective. Many large clinical trials compare the more commonly used standard 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. Clinical trials should be reviewed by an independent ethics committee that approves and monitors the research study such as an institutional review board (IRB). All patients who participate in clinical trials are carefully monitored to make sure they are getting quality care. Enrolling in clinical trials is completely voluntary. You can leave a trial at any time. Clinical trials testing new treatments are carried out in phases.



Phase I — Is the Treatment Safe?

When doctors are developing a new treatment, the first step is to determine the maximum safe dose of treatment that can be administered. This needs to be done before any determination of whether the drug is effective. Radiation phase I trials are different since radiation oncologists already know the standard doses of radiation that are effective. Phase I radiation trials may investigate combining radiation therapy with other treatments such as surgery or drugs or evaluate new techniques of delivering radiation therapy. These trials examine if the new treatment is safe and feasible.

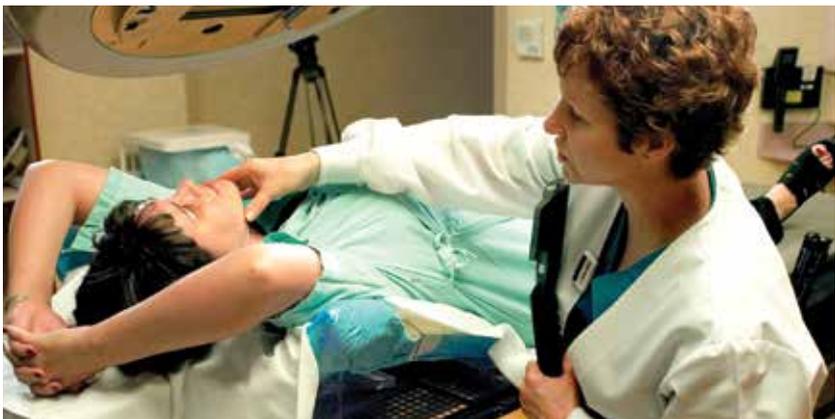


Phase II — Does the Treatment Work?

In a phase II radiation study, radiation oncologists are trying to establish if the new treatment is effective. Researchers want to know if the new treatment shows enough promise in terms of controlling the tumor that it is worth testing against the standard therapy in a phase III trial. Side effects are closely monitored.

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 two groups. This is the gold standard of clinical research trials. If a new treatment is shown to be better than standard treatment in terms of cancer control and side effects in a phase III trial, experts will reconsider standard of care treatment.





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. Several hundred to several thousand people are enrolled in a phase IV trial.

Deciding to participate in a clinical trial is a personal decision that only the patient can make. Before enrolling, patients should learn as much as possible about cancer treatment and the clinical trials that are available. Patients should ensure that the clinical trial has been reviewed by an IRB. The radiation treatment team can answer any questions if a patient is considering a trial. Another good resource is the **National Cancer Institute** at **1-800-4-CANCER** or **www.cancer.gov**.

HOW CAN PATIENTS BEST CARE FOR THEMSELVES DURING RADIATION THERAPY?

You should 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 needed to focus on fighting cancer. If more help is needed, social workers or nurses may have more information on local cancer support groups or other resources. Volunteers also may be able to help.

Even though rest is important, there is good evidence to suggest that some physical activity during treatment can help decrease fatigue. For example, many patients feel a daily walk helps decrease some of their treatment-related fatigue. You should ask your radiation oncologist what the best form of daily exercise might be for you.

Follow the doctor's orders. In many cases, your doctor will ask you to call if any concerning symptoms develop. For example, the treatment team may direct you to call with a fever of 101 degrees F or higher. It is important to read and follow these instructions during treatment. If you are unsure, you should not hesitate to contact the treatment team with questions.

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 needed to fight the cancer and allow the body to heal. 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 will need more calories due to the cancer and treatment.



Stay hydrated. In some cases, you may be at risk of becoming dehydrated during treatment. Helpful fluids may include electrolyte solutions, juice, sorbet, broth and water. You should discuss with your doctor what strategies will work best.

Treat skin exposed to radiation with extra care. The skin in the area receiving treatment may become red and sensitive, similar to a sunburn.

The radiation oncology nurses will review specific instructions for skin care. Some guidelines include:

- Clean the skin daily with warm water and a mild soap recommended by the team.
- Avoid using any lotions, perfumes, deodorants or powders in the treatment area unless approved by the team. Avoid products containing alcohol, which may cause dryness.
- 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 be outdoors, you should wear a hat or clothing to protect the skin. After treatment, use sunscreen with an SPF of at least 15.



Seek out support. There are many emotional demands on you and your caregivers during the cancer diagnosis and treatment. It is common to feel anxious, depressed, afraid or hopeless. It may help to talk about these feelings. To find a support group in the area, ask the radiation treatment team. There are many groups that meet in person, over the phone or on the Internet. Some support organizations can even help manage financial issues, such as insurance and co-pays.

WHAT QUESTIONS SHOULD PATIENTS ASK THE DOCTOR?

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?
- How long will I receive radiation? How many treatments will I receive per week?
- What are the chances that radiation therapy will work? Are there any other effective treatments?
- 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 will the treatments be coordinated?
- Is there a clinical trial for which I might be eligible? Should I participate in a clinical trial?
- What are the benefits and risks of treatment including short-term and long-term side effects?
- What are some of the support groups I can turn to during treatment?
- Will radiation therapy affect my ability to have children?
- If I have questions after I leave here, who can I call or email?
- How should I prepare for this financially?
- Do you take my insurance? Is there a co-pay?
- Is this the most convenient location for treatment (close to home or work?)

Questions to Ask During Treatment

- Can I drive myself to and from the treatment facility? Where should I park?
- What side effects may occur from the radiation treatment and how are they managed?
- Do I need a special diet during or after my treatment?
- Will I be able to continue my normal activities?
- Can I smoke or drink alcohol?
- Is it safe to take vitamins or other supplements during treatment?
- How can I expect to feel during treatment and in the weeks following radiation therapy?

Questions to Ask After Treatment Ends

- What are reasons that I should call you after my treatment ends?
- How and when will I know if I am cured of cancer?
- What are the chances that the cancer will come back?
- How often do I need to return for checkups?
- What are the concerning long-term side effects? How can I monitor for these?
- How soon can I go back to my regular activities? Work? Sexual activity? Exercise?

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.rtanswers.org.



I may need radiation therapy. Now what?

Go to www.ranswers.org for answers to your radiation therapy questions.



- What is radiation therapy?
- How does radiation work for my illness?
- What should I ask my doctor?
- What do these terms mean?
- Who will I see during my treatments?
- Will there be side effects?
- Where can I go for support?

Receiving a diagnosis of cancer can be frightening and confusing. To help you better understand the treatment options available, ASTRO created this website to explain how doctors use radiation therapy to treat cancer safely and effectively.

RTAnswers
ANSWERS TO YOUR RADIATION THERAPY QUESTIONS

THE AMERICAN SOCIETY FOR RADIATION ONCOLOGY (ASTRO) is the largest radiation oncology society in the world, with more than 10,000 members who specialize in treating patients with radiation therapies. As the leading organization in radiation oncology, biology and physics, ASTRO's mission is to advance the practice of radiation oncology by promoting excellence in patient care, providing opportunities for educational and professional development, promoting research and disseminating research results, and representing radiation oncology in a rapidly evolving health care environment.

Visit www.astro.org for more information.



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