



ABOUT BRAIN TUMORS

There are two general types of brain tumors:

A **primary tumor** starts in the brain. It can be benign (less likely to grow and/or invade the normal functioning brain) or malignant (more likely to grow and/or invade the normal functioning brain). Primary tumors in the brain or spinal cord rarely spread to distant organs.

A **metastatic tumor** is caused by cancer elsewhere in the body that spreads to the brain. Metastatic brain tumors are always malignant.

This brochure is designed to address primary brain tumors. For information about radiation treatment for metastatic brain tumors ask your nurse or doctor for the brochure Radiation Therapy for Brain Metastases or go to www.ranswers.org.

TREATING BRAIN TUMORS

If doctors determine that you have a brain tumor, the treatment options and prognosis are based on many factors including tumor type, location and size of the tumor, grade (how aggressive it appears), molecular characteristics of your tumor, your age and your overall health. Depending upon these and other factors, surgery, radiation therapy and/or medical therapy (chemotherapy) may be treatment options.

Radiation Therapy

Radiation therapy, sometimes called radiotherapy, is the careful use of high-energy X-rays or particles to safely and effectively treat brain tumors. Radiation works noninvasively within tumor cells by damaging their ability to grow. Healthy cells near the tumor may be affected by radiation, but they are able to repair themselves in a way tumor cells cannot. Radiation therapy can be used after surgery, or in some cases instead of surgery. Ask your radiation oncologist about whether radiotherapy could be helpful for your treatment.

Surgery

For many brain tumors, surgery is an important part of treatment. A neurosurgeon may perform a surgical biopsy to determine what kind of tumor

you have. Sometimes only a part of the tumor can be safely removed in order to minimize the effects on your normal functioning, while other times all of the visible tumor can be safely removed. The extent of surgery is mainly based on the location of the tumor. Depending on your tumor, surgery may be the only treatment needed. However, radiation is often used after surgery to lessen the chances of the tumor coming back in the same place or growing in another part of the brain. Ask your surgeon about the type and extent of surgery that is recommended for you.

Medical Therapy

Anti-cancer drugs known as chemotherapy may be given in addition to radiation to make treatment more effective or instead of radiation. Chemotherapy has the ability to destroy cancer cells by different methods. Depending upon the kind of drug best suited for your kind of brain tumor, chemotherapy may be given as a pill or through an intravenous (IV) line directly into your bloodstream on a set schedule. Chemotherapy can be given before, during or after radiation therapy. The type of chemotherapy you receive may be dependent on the molecular characteristics of your tumor. For more details about chemotherapy or other medications, ask your medical oncologist or neuro-oncologist which medications may be best for you.

Anti-mitotic Therapy

For patients with high-grade primary brain tumors (glioblastoma multiforme or GBM) or primary brain tumors that come back after initial treatment, an external treatment device that delivers a low-voltage electric field around the tumor area may be part of your treatment plan. The tumor treatment fields (TTFs) made by this system prevents the growth of cancer cells and works in a different way than radiation and chemotherapy.

EXTERNAL BEAM RADIATION THERAPY

External beam radiation therapy usually involves a series of outpatient treatments with a machine called a linear accelerator, or linac. Similar to a chest X-ray, treatment X-rays cannot be seen or felt and the machine does not touch you. Treatments are given daily, Monday to Friday, usually over three to seven weeks.

Before beginning treatment, you will be scheduled for a planning session to map out your treatment area. This procedure is called a simulation. Simulation involves a CT scan which is performed while lying on a table, usually with aid of a form-fitting mask to make sure treatment is delivered the same way each time. Your doctor will design an individualized treatment plan based on the results of the simulation scan together with other imaging studies you have completed including MRIs. Marks are made on the mask to help the radiation therapist precisely position you for daily treatment.

Different techniques can be used to give radiation for brain tumors. **Three-dimensional conformal radiotherapy** (3-D CRT) combines multiple X-ray beam treatment positions and beam shapes to deliver precise doses of radiation to the brain. Tailoring each of the radiation beams to the patient's tumor allows coverage of the diseased cells while keeping radiation away from nearby organs, such as the eyes.

Intensity modulated radiation therapy (IMRT) is a form of 3-D CRT that further modifies the amount (intensity) and shape of the radiation within each of the radiation beams. At most centers, X-rays (photons) are used for treatment.

Image-guided radiation therapy (IGRT) can be used with any of these techniques. IGRT uses imaging (X-rays, CT and MRI scans) to verify that you are positioned correctly each day before the radiation beam turns on.

These more precise treatment techniques can be used if the tumor is in a sensitive part of the brain or if you have had radiation treatments in the past. Ask your radiation oncologist about which radiation technique is best for treating your tumor.

PROTON BEAM THERAPY

Proton beam therapy delivers radiation therapy using particles instead of an X-ray beam. The benefit of proton therapy is that there is little to no radiation dose beyond the treatment area. This means that your doctor may be able to decrease dose to the surrounding healthy brain, which could lead to fewer side effects during or after completion of radiotherapy. Proton therapy also may

allow delivery of radiation a second time or a higher dose of radiation for certain tumors involving the base of the skull. This treatment is not yet widely available throughout the United States. Ask your doctor if proton therapy might be beneficial for you.

STEREOTACTIC RADIOSURGERY / RADIOTHERAPY

Stereotactic radiosurgery (SRS) and **stereotactic radiotherapy** (SRT) are ultra-precise forms of radiotherapy. In certain situations, a stereotactic form of radiation may be recommended by your radiation oncologist or neurosurgeon to be used in addition to regular radiation, on its own or possibly instead of surgery. Sometimes SRS/SRT requires the placement of a frame that attaches to the skull while some systems allow the use of a tight fitting mask. The benefit of SRS/SRT is that the total radiation dose (which can be a higher dose than standard radiation) is delivered in one to five treatment sessions with very little radiation to the surrounding healthy tissue. You can ask your doctor to learn more about stereotactic radiation and whether this technique will be a helpful part of your treatment.

CARING FOR YOURSELF DURING TREATMENT

Battling cancer is tough. Seek out help from support groups and friends.

- Get plenty of rest during treatment, and don't be afraid to ask for help.
- Follow your doctor's orders. Ask if you are unsure about anything. There are no stupid questions.
- Tell your doctor about any medications, vitamins or supplements you are taking to make sure they are safe to use during radiation therapy.
- Eat a balanced diet. If food tastes funny or if you're having trouble eating, tell your doctor, nurse or dietician. They might be able to provide you with some helpful suggestions.
- Treat the skin exposed to radiation with special care. Stay out of the sun, avoid hot or cold packs; only use lotions and ointments after checking with your doctor or nurse; and clean the area with warm water and mild shampoo or baby shampoo.

Possible Side Effects

Visit www.rtanswers.org to download a complete chart of side effects.

Organ System	Possible Side Effects of Radiotherapy for Brain Tumor Treatment	
	Acute Complications (During Treatment and Up to Three Months After Treatment Ends)	Chronic Complications (Months to Years after Treatment)
General	<ul style="list-style-type: none"> Acute Fatigue Weight loss Seizures 	<ul style="list-style-type: none"> Chronic fatigue Pituitary gland damage (may require hormone replacement therapy) Seizures
Skin & Scalp	<ul style="list-style-type: none"> Irritation Redness Hair loss (partial or complete) Possible peeling and/or blistering 	<ul style="list-style-type: none"> Permanent changes to the skin color (change) Altered or incomplete hair regrowth (may affect part or all of the scalp)
Brain	<ul style="list-style-type: none"> Headaches Swelling of the brain which can cause altered sensation, decreased strength, altered nerve function, and/or increased risk for seizures 	<ul style="list-style-type: none"> Headaches Damage to normal brain causing alteration in ability to reason or remember, loss of strength or sensation in parts of body controlled by affected brain area
Eyes	<ul style="list-style-type: none"> Eye irritation Eye dryness 	<ul style="list-style-type: none"> Cataract formation Eye dryness Loss of vision from eye or nerve damage (rare)

LEARNING ABOUT CLINICAL TRIALS

The radiation oncology team is constantly exploring new ways to treat brain tumors through studies called clinical trials. Today's standard treatments are the result of clinical trials proving that radiation therapy kills tumors and is safe long-term. For more information on clinical trials, visit:

National Cancer Institute
www.cancer.gov

NRG Oncology (Clinical Trials Using Radiation)
www.nrgoncology.org

Clinical Trials.gov
www.clinicaltrials.gov

HELPFUL WEBSITES ON BRAIN TUMORS

American Brain Tumor Association
www.abta.org

National Brain Tumor Society
www.brainumor.org



ABOUT THE RADIATION ONCOLOGY TEAM

Radiation oncologists are the doctors who oversee the care of each person undergoing radiation treatment. Other members of the treatment team include radiation therapists, radiation oncology nurses, medical physicists, dosimetrists, social workers and nutritionists. For information on what each of these professionals does or to locate a radiation oncologist near you, visit www.rtanswers.org.

ABOUT ASTRO

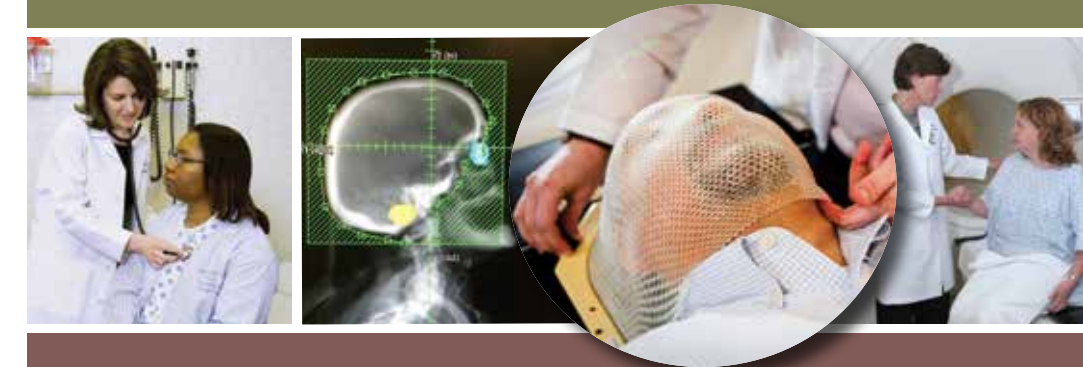
The American Society for Radiation Oncology is the premier radiation oncology society in the world with more than 10,000 members who specialize in treating cancer with radiation therapies. ASTRO is dedicated to improving patient care through education, clinical practice, advancement of science and advocacy.

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Radiation Therapy for Brain Tumors



The brain is the center of thought, memory, emotion, speech, sensation and motor function. The spinal cord and special nerves called cranial nerves carry and receive messages between the brain and the rest of the body. Brain tumors cause damage because, as they grow, they can interfere with surrounding cells that serve vital roles in our everyday life.

The Central Brain Tumor Registry of the United States estimates that more than 688,096 persons are living with a diagnosis of primary brain and central nervous system tumors in the United States.

An estimated 77,670 new cases of primary benign and malignant brain and central nervous system tumors are expected to be diagnosed in the United States in 2016.



TARGETING CANCER CARE

Side effects are different for everyone. Some patients feel fine during treatment while others may feel uncomfortable. Before treatment, ask your doctor to describe what you can expect.

- **Fatigue**, or mild tiredness, may develop starting in the middle of the treatment course. However, tiredness from radiation should improve within a few weeks after radiation treatment ends.
- **Hair loss** may occur but only in the area being treated.
- **Mild skin irritation**, itchy or red scalp and/or dry peeling of the skin may occur with external beam radiation. Clean the area regularly with mild soap and warm water.
- **Headaches** are a common side effect of any treatment for brain tumors.
- **Decreased or muffled hearing** may occur. Additionally, you may experience inflammation of the ear canal with irritation, discharge, dizziness or sense of "fullness."

Radiation may also cause **short-term memory loss**, difficulty thinking and slowness in completing tasks. Some patients benefit from medicine or a specialized radiation technique that can reduce short-term memory loss. Ask your doctor if these options are available for you.

Side effects are different for each patient. Medications may be prescribed to make you as comfortable as possible. If at any time during your treatment you feel discomfort, tell your doctor or nurse.