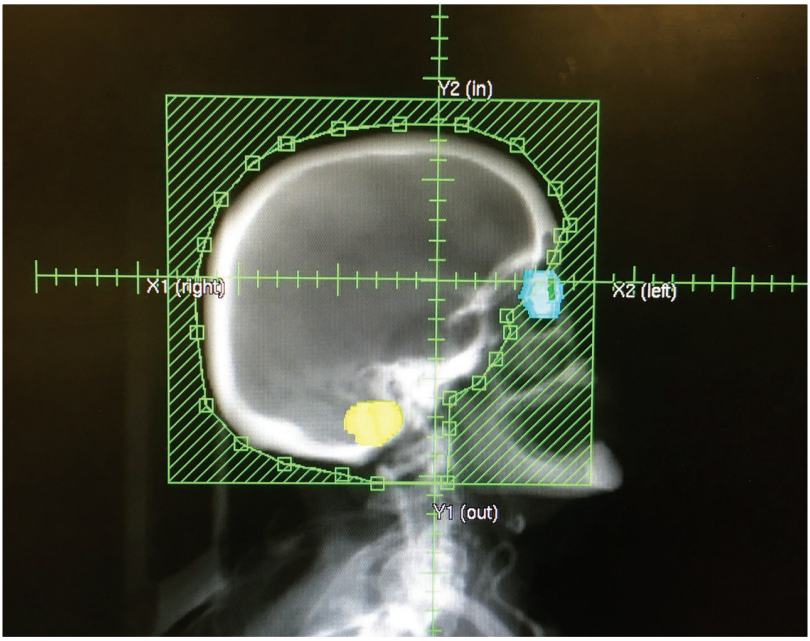
RADIATION THERAPY FOR BRAIN TUMORS

ASTRO

AMERICAN SOCIETY FOR RADIATION ONCOLOGY

RADIATION THERAPY FOR BRAIN TUMORS

contents



The brain controls our neurologic function. This includes mood, memory, strength, sensation and coordination. Tumors in the brain take up space and push on the brain. This can cause symptoms such as headaches, nausea, seizures, weakness, difficulty with speech and changes in vision or hearing. Many brain tumors have no symptoms and can only be found by imaging such as MRI. Once these tumors are found they are reviewed by a group of different cancer specialists to determine treatment options going forward.

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 other sites in the body.

A metastatic (or secondary) tumor is caused by cancer elsewhere in the body that spreads to the brain. Metastatic brain tumors are always malignant and are much more common than primary brain tumors.

Over the past few years, it has become more important to understand the molecular features of brain tumors. This usually means extra tests are done on the biopsy or surgery specimen to determine if particular biological markers are present or absent. Examples of some of these markers include EGFR, ALK, MGMT, 1p19q, IDH1 and TERT. The results of the tests can determine the type of treatment that is offered for a particular brain tumor. Ask your cancer doctors whether molecular testing is needed in your case.

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, medical therapy (chemotherapy, targeted therapy or immunotherapy), anti-mitotic therapy or some combination may be treatment options.

Radiation Therapy

Radiation therapy involves the precise use of high-energy X-rays or particles to safely and effectively treat brain tumors. Radiation works 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 cancer doctors if radiation therapy could be helpful for your treatment.

Surgery

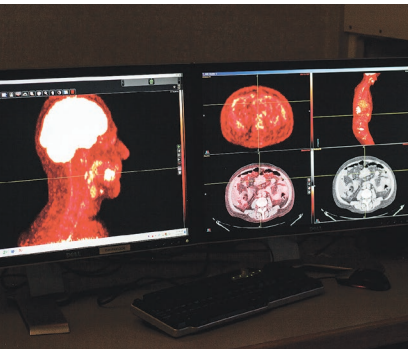
For many brain tumors, surgery is an important part of treatment. A neurosurgeon may perform a surgical biopsy to determine what kind of tumor you have. Sometimes only a part of the tumor can be safely removed in order to preserve your quality of life and function, while other times all of the visible 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. In some cases,

radiation is used instead of or after surgery to lessen the chances of the tumor returning in the same place or growing in another part of the brain. Ask your surgeon what type of surgery is recommended for you.

Systemic Therapy

Anti-cancer drugs may be given in addition to radiation to make treatment more effective or can sometimes be used instead of radiation. These include chemotherapy, targeted therapies and immunotherapy. 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 or after radiation therapy, but is generally not given during radiation therapy. Targeted therapy uses drugs to target specific genes and proteins, that help cancer cells survive and grow.

Immunotherapy utilizes the body's own immune system to recognize and attack tumors. The type of systemic therapy you receive may be dependent on the molecular characteristics of your tumor. Ask your medical oncologist or neuro-oncologist which medications may be best for you.



Anti-mitotic Therapy

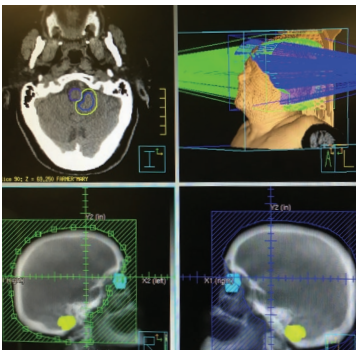
For patients with high-grade primary brain tumors (glioblastoma multiforme or GBM) or primary brain tumors that come back after initial treatment, an external treatment device that delivers a low-voltage electric field around the tumor area may be part of your treatment plan. The tumor treatment fields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

EXTERNAL BEAM RADIATION THERAPY

External beam radiation therapy usually involves a series of outpatient treatments using a linear accelerator, or linac. Similar to an X-ray, treatment X-rays cannot be seen or felt. Radiation does not travel throughout the body and is only directed to the treatment site. The only time radiation is present is during your treatment session while the machine is turned on. You will not be radioactive afterwards. Treatments are typically given daily, Monday to Friday, and can be a single treatment or up to multiple consecutive weeks.

Before beginning treatment, you will be scheduled for a planning session, called a simulation, to map out your treatment area. Simulation involves a CT scan which is performed while lying on a table, usually with the aid of a form-fitting mask or a head frame to help the radiation therapist precisely position you for daily treatment. Your doctor will design an individualized treatment plan based on the results of the simulation scan together with other imaging studies you have undergone including MRIs.

Different techniques can be used to give radiation for brain tumors. Radiation treatment plans are created to deliver precise doses of radiation to the areas of the brain at risk while avoiding normal organs. 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 external beam therapy 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.

Hippocampus Avoiding IMRT (HA-IMRT) is an advanced form of radiation used for treatment of brain metastases (cancer that has spread from another part of the body to the brain). The hippocampus has been shown to be related to preserving short-term memory after radiation to the brain. This type of treatment is commonly combined with a medicine called memantine. If your doctor has recommended whole brain radiation, you can ask whether hippocampal avoiding IMRT is appropriate in your case.

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.

STEREOTACTIC RADIOSURGERY / RADIOTHERAPY

Stereotactic radiosurgery (SRS) and stereotactic radiotherapy (SRT) are ultra-precise forms of external beam 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 others use a tight-fitting mask. The benefit of SRS/SRT is that the total radiation dose is delivered in one to five treatment sessions with very little radiation to the surrounding healthy tissue.

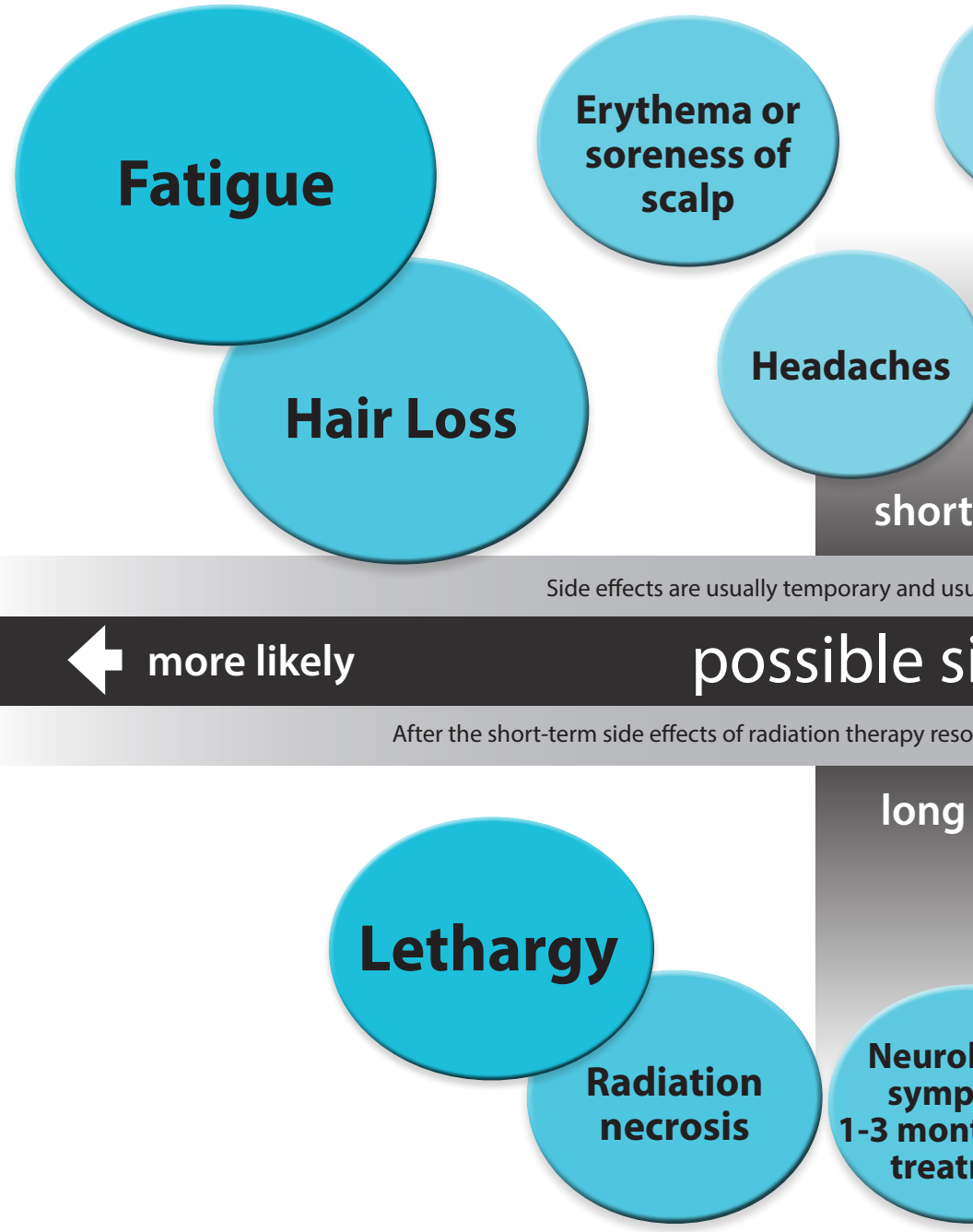
PROTON BEAM THERAPY

Proton beam therapy delivers radiation therapy using particles instead of an X-ray beam. The potential 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 total dose of radiation for certain tumors. This treatment is not yet widely available throughout the United States.

CARING FOR YOURSELF DURING TREATMENT

Battling cancer is tough. You may have a lot to cope with. Ask your treatment team, family or friends for help.

- Get plenty of rest during treatment, and don't be afraid to ask for help.
- Ask your doctor questions about anything you are unsure of.
- 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.
- Avoid any significant changes to hairstyle to ensure proper fit of your mask.
- Treat the skin exposed to radiation with special care. Stay out of the sun and avoid hot or cold packs. Use lotions and ointments only after checking with your doctor or nurse. Skin toxicity is usually quite minimal for SRS.



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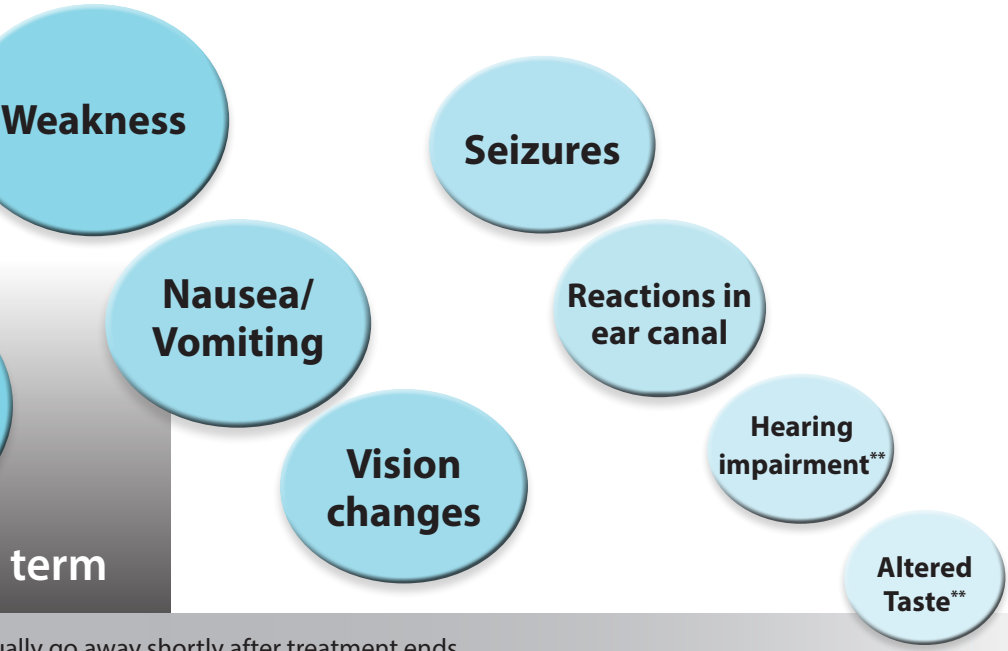

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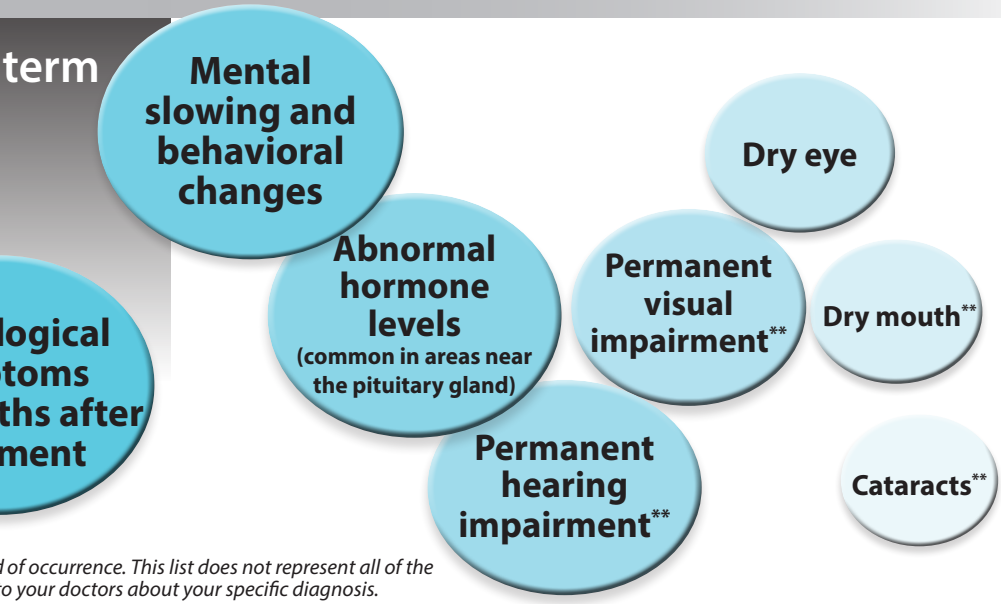


d of occurrence. This list does not represent all of the
o your doctors about your specific diagnosis.
fects are all very uncommon

SUGGESTED QUESTIONS TO ASK YOUR TEAM

What stage is the cancer?

What are the treatment options?

Are there any other physicians that I need to see?

What are the benefits and risks of having this treatment?

Are there alternatives to having this treatment?

What is my life going to look like (e.g., number of visits, types of visits)?

What can be done to prepare for this treatment?

How many treatments will I have?

How long will it take to get treatment started?

What are the potential short-term and long-term treatment side effects?

Who can I contact if I have questions or concerns during the treatment?

How will the cancer be monitored after treatment?

What can be done if the cancer comes back after treatment?

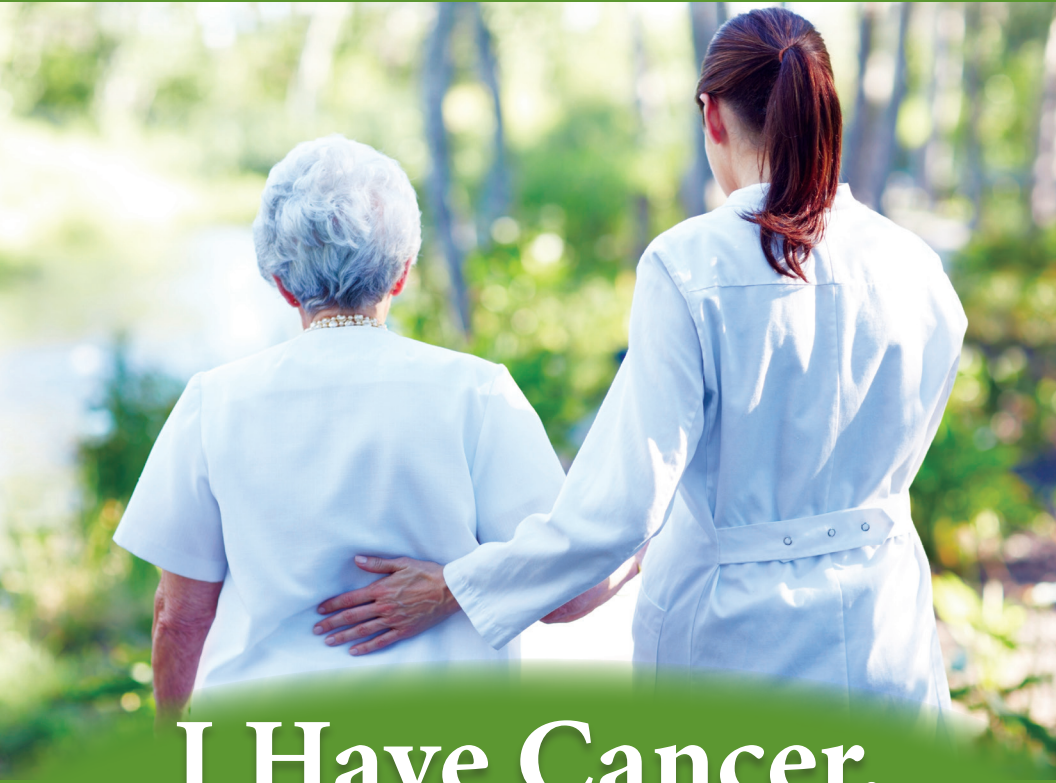
What kind of follow-up will I have with your team?

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.

ABOUT THE RADIATION ONCOLOGY TEAM

Radiation oncologists are doctors who specialize in the use of radiation therapy as a treatment for cancer. Other members of the treatment team include radiation therapists, medical physicists, dosimetrists, radiation oncology nurses, medical assistants, social workers and nutritionists. For information on what each does or to find a radiation oncologist near you, visit www.rtanswers.org.

RTAnswers
ANSWERS TO YOUR RADIATION THERAPY QUESTIONS



I Have Cancer. Now What?

Receiving a diagnosis of cancer can be frightening and confusing. **RTAnswers.org** provides detailed information and resources for cancer patients and their caregivers, including:

- Treatment information by disease site.
- Videos walking you through the radiation therapy treatment process.
- Stories from patients and caregivers sharing their experiences from diagnosis and treatment to survivorship.
- A "Find a Radiation Oncologist" portal where you can search by city, state and disease site specialty.

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 specialty of radiation oncology through promotion of equitable, high-quality care for people with cancer, cultivating and educating a diverse workforce, fostering research and innovation, and leading policy development and advocacy. Visit www.astro.org for more information.

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