

# Understanding Brain Tumors



*Glioblastoma*  
*Multiforme*



**NATIONAL BRAIN TUMOR  
FOUNDATION**

GIVING HELP, GIVING HOPE®

INFORMATION LINE: 800.934.CURE

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## Introduction



**T**he diagnosis of a brain tumor often happens quickly and with little advance notice. Since it is important that patients actively take part in their own medical treatment, they must be informed about their particular type of brain tumor and the options available to them. The National Brain Tumor Foundation (NBTF) has been providing information and support services to brain tumor patients, survivors, and their families since 1981. We hope this booklet helps in learning about glioblastoma multiforme and in evaluating the options throughout therapy and thereafter.

## What Is a Brain Tumor?

A brain tumor is a collection of cells that grows out of control from the normal cell mechanisms. Also called a neoplasm, growth, mass, or lesion, a brain tumor is classified as either primary or secondary (metastatic).

- *Primary brain tumors* develop and generally remain in the brain.
- *Secondary brain tumors*, or metastatic brain tumors, develop elsewhere in the body and spread to the brain.
- *Malignant brain tumors* grow rapidly and invasively.
- *Benign brain tumors* generally do not grow rapidly. However, even benign tumors can be life threatening.

## What Is Glioblastoma Multiforme ?

There are many different types of malignant or cancerous brain tumors. The most common type of primary brain tumors are the *gliomas*. One type of a glioma is an astrocytoma. Astrocytomas are graded I through IV, depending on the degree of aggressiveness. The most aggressive astrocytoma, grade IV, is also called a *glioblastoma multiforme* (GBM). Of all brain tumors, GBM has the greatest potential for rapid growth.

GBMs mainly arise in the cerebral hemispheres (the main portions of the brain), but they can also occur in the brain stem, cerebellum, or spinal cord. Symptoms of a GBM can include headaches that are caused by increased intracranial pressure, memory loss, seizures, personality changes, and coordination difficulties. The spread of a GBM to other parts of the body is extremely rare.

## Who Gets Glioblastoma Multiforme?

**G**GBMs usually affect men more commonly than women, particularly men between the ages of 40 and 60 years. GBM is rare in children, comprising 5% to 10% of all childhood tumors. About one-quarter of all adult primary brain tumors are GBMs.

At present, there is no known cause for GBMs, but studies have examined electromagnetic fields, chemicals, and family hereditary connections.

## How Is a Glioblastoma Multiforme Diagnosed?

The main ways of diagnosing a brain tumor are by the use of a CT scan (computerized tomography), an MRI (magnetic resonance imaging), or a PET Scan (Positron Emission Tomography). Because of the distinct shape of a GBM, the doctor is able to have a fairly good idea of the tumor type by examining the MRI scan. But for a definitive diagnosis, a sample of the tumor must be analyzed by a pathologist. This is called a biopsy and can be done at the time of surgery.

**CT SCANNING** provides successive X-ray views of thin sections of the brain, increasing the likelihood that a tumor can be detected at an early stage. Contrast agents, given by injection before CT scanning, are used to improve the contrast between light and dark areas of the scan.

**MR IMAGING, OR MRI**, is a very precise and sensitive diagnostic test for detecting tumors. Unlike CT scanning, an MRI does not use radiation, but makes use of magnetic field patterns, using a contrast agent called gadolinium. *For diagnosing a brain tumor and follow-up, an MRI is generally the preferred method.*

**PET SCAN** is a relatively new test that measures cellular activity. An injection of radioactive glucose dye is given to the patient and then a scan is made. This technique can be especially useful in distinguishing dead tissue masses from active tumor cells, although this test is not always 100% accurate.

## **Do Diagnostic Tests Have Any Side Effects?**

In some patients, iodine, the contrast agent most commonly used for CT scanning, may cause a reaction such as a rash, a warm sensation, or in rare cases some breathing difficulty.

Gadolinium, the contrast agent used with an MRI, may cause a temporary headache but has no other known side effects. Because an MRI uses magnetic fields, people who have metal implanted in their body in any form should let the doctor know about it.

In addition, medication can be available to help relieve the symptoms of apprehension when having an MRI. Patients should let the doctor know of their concerns before scheduling an MRI.

## **Once a Brain Tumor Is Diagnosed, How Is It Treated?**

Generally, standard treatment consists of surgery, radiation therapy, and chemotherapy. The goal of surgery is to confirm the diagnosis by removing a small biopsy specimen of the tumor for the pathologist's examination, and then removing as much of the tumor as possible. Radiation therapy and chemotherapy are usually used as secondary treatments to destroy tumor cells that cannot be removed by surgery. The goal of treatment is to alleviate symptoms and control the growth of any remaining tumor as long as possible with the fewest possible side effects.

## **What Is Important to Know About Surgery?**

**S**urgery is performed by a neurosurgeon. Except in cases of GBMs that cannot be treated surgically because of their location or extent of invasiveness, the neurosurgeon operates to remove as much of the tumor as possible.

There are several factors that determine how the neurosurgeon decides whether surgery is possible, including the location of the tumor, the extent of its invasiveness, or its relation to the blood supply within the brain.

One of the most important advances in the surgical treatment of brain tumors has been the surgical microscope, which gives neurosurgeons a clear view of even the smallest area of tissue and allows great precision in performing delicate operations. Together, the surgical microscope and microsurgical techniques—aided by new navigational devices (ISG, Stealth, Brainlab, Microscope Mounted) for on-screen monitoring during the operation—afford a greater chance of finding and removing the divergent areas of invasive GBMs. The more of the tumor that can be removed surgically, the better the prognosis.

## **What Is the Treatment After Surgery? (Or When Surgery Is Not Recommended)**

For patients who have already completed surgery, or in cases where surgery is not advised, treatment with radiation therapy and/or chemotherapy is recommended.

## ***Radiation Therapy***

Radiation therapy is given by a *radiation oncologist*. After reviewing the scans or images of the tumor area, the radiation oncologist works with the neurosurgeon to plan an appropriate course of radiation therapy. The radiation oncologist will also discuss possible benefits and side effects of this therapy with the patient.

The goal of radiation therapy is to destroy tumor cells without injuring normal brain cells around the margin of the tumor. Radiation treatment may be given in a single dose each day, or it may be divided (hyperfractionated) into two or more daily doses for the recommended course of treatment, usually two to six weeks. The type of radiation patients receive will depend on what they and their radiation oncologist determine to be the most effective.

Techniques for delivering the best radiation treatment will be evaluated by the radiation oncologist depending on the type of tumor and location. Currently available techniques are conventional 2D coplanar treatment, 3D conformal treatment, intensity modulated treatment (peacock), or radio-surgery technique.

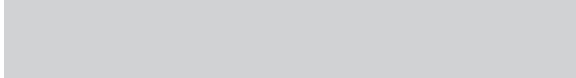
Following surgery, radiation therapy is the single most effective treatment for GBM, and it is used as the primary treatment for cases in which surgery would involve too great a risk to the patient. Radiation therapy has resulted in better survival rates than either surgery alone or surgery plus chemotherapy.

## Are There Different Types of Radiation Therapy?

**B**elow is a list of some of the types of radiation therapy that may be used to treat brain tumors. Patients should discuss the benefits and side effects of each treatment with their doctors.

**BRACHYTHERAPY** (brachy—Greek for short), also called interstitial irradiation, entails the surgical implantation of radioactive sources directly into the brain permitting a dose of radiation to be delivered locally within the tumor while sparing the surrounding brain tissue. In one technique, the radioactive sources (in the form of seeds), remain inside the tumor for usually six to seven days before they are withdrawn. In some cases, the sources are left in place permanently. The size of the tumor and its location in the brain determine if seeds can be implanted, how many seeds are implanted, and how long they are left in place. Sometimes, when combined with surgery and conventional radiation therapy, brachytherapy has shown improved survival time for patients *with GBMs that meet specific criteria*, but those are still fairly few in number.

**HYPERTHERMIA**, heating the tumor to high temperatures in order to kill or damage tumor cells, is being used in combination with interstitial irradiation. Combined, these techniques provide a double measure of therapy, as cells that escape the increased heat can be killed by radiation, and those that escape the radiation can be killed by the heat.



**RADIOSURGERY** is a stereotactic technique for delivering a finely focused, high-dose radiation beam to a target abnormality deep within the brain. Stereotactic technique involves holding and bracing the head in a fixed position. This nonsurgical technique aims multiple precisely focused radiation beams directly at the tumor site, sparing healthy tissue as much as possible and enabling a higher dose of radiation to be delivered to the specific site than with standard radiation therapy. Like brachytherapy, radiosurgery delivers the radiation primarily to the tumor site. However, radiosurgery is less invasive and does not entail the risks associated with surgery.

Stereotactic radiosurgery can be delivered through different systems, such as the *X-Knife*<sup>™</sup> (based on a linear accelerator or LINAC), or the *Gamma Knife*.<sup>™</sup> Based on the patient's CT scans or MR images, the exact location of the tumor inside the brain is defined. In conjunction with the system's computer software, a treatment plan is developed that conforms to the shape of the tumor while minimizing radiation to the rest of the brain. At this time, however, only small recurrent GBMs can be treated with radiosurgery. In select cases, radiosurgery can also be used to deliver a radiation boost in addition to standard external beam radiotherapy. As questions about dosages are resolved and criteria are identified for selecting tumors that will respond to radiosurgery, these techniques are becoming more valuable for treating brain tumors that are inaccessible to the surgeon.

## What Is Chemotherapy?

After surgery and radiation therapy, chemotherapy (therapy with drugs) may be given and is administered by a neuro-oncologist or medical oncologist.

Chemotherapy works to destroy remaining tumor cells with drugs given either alone or in combination with other treatments. Drugs called nitrosoureas, such as BCNU (carmustine), and CCNU (lomustine) are standard in many regimens; however, many new chemotherapeutic agents are being used to investigate their efficacy.

Chemotherapy is usually given by mouth or injected in a vein. Among the newer techniques approved by the FDA for treatment of *recurrent* GBM is the use of biodegradable polymer wafers impregnated with the treatment drug. These are placed directly inside the tumor cavity at the time of surgery. The wafers safely disintegrate as they release doses of chemotherapy directly into the tumor cavity. Clinical trials of this treatment method are ongoing. Other research focuses on drugs that temporarily increase the permeability of the blood-brain barrier, allowing chemotherapeutic agents a greater opportunity to reach the tumor site.

The medical oncologist/neuro-oncologist will work with the neurosurgeon, radiation oncologist, and the patient in order to plan an appropriate course of chemotherapy.



## **Are There Side Effects to Treatment?**

All valuable treatments for brain tumors have the potential for side effects. Because chemotherapy and radiation can't always be directed exclusively at the tumor, they can potentially damage healthy as well as diseased tissues.

Chemotherapy may cause nausea and can be associated with fatigue, weight loss, and increased risk of infection. Each drug has a particular profile of side effects that the oncologist will discuss with the patient.

Radiation therapy is generally done on an outpatient basis with daily treatments. Patients are usually able to function at a normal level throughout the treatment although some people may notice fatigue toward the end of the therapy. Radiation therapy may cause patchy hair loss and a dry scalp, and in some rare cases, a slight worsening of neurological problems.

Currently, there are many drugs that can help alleviate the side effects of treatment. Patients should discuss with their doctors the different options for treating any side effects that might arise.

## **Are There Medications That Are Given to Treat the Symptoms of GBM?**

The two most common medications are steroids, to reduce swelling, and anticonvulsant medications, to prevent seizures.

### ***Steroids***

Steroids are given to reduce fluid retention and control swelling of the brain, particularly before and after surgery. They do not kill tumor cells, but used alone or combined with other forms of treatment, they can bring about remarkable improvement in a patient's condition simply because of rapid control of cerebral edema (swelling). When used for only a few days, steroids generally cause no side effects except possible flushing of the face, mild fluid retention, swelling of the hands, feet, or face, and an increase in appetite. Used over a long period of time, however, steroids may produce physical and mental reactions such as a change in the patient's body, including swelling of the face, arms, and legs, possible mood swings, acne, and softening of the bones. Other effects include decreased strength in the patient's legs, more fragile skin, increased potential for sugar diabetes, and water and fat weight gain. These side effects usually disappear when the drug is *carefully* discontinued. It is very important that a doctor carefully supervises discontinuation of steroids, usually gradually, even if they are causing unpleasant side effects, because abrupt discontinuation of these drugs can cause severe problems.

## ***Anti-Seizure Medications***

To help protect patients from having seizures, and possibly even keep them free from seizures, their doctor may prescribe an anticonvulsant drug, such as Dilantin (Phenytoin); Tegretol (Carbamazepine); Luminal (Phenobarbital); Depakene, Depakote (Valproate); Mysoline (Primidone); Zaronti (Ethosuximide); or Klonopin (Clonazepam), to name a few. Patients should discuss with their doctor the side effects of drugs, the amount that is prescribed, and the methods of monitoring the effectiveness of the specific drug they are using.

## **How Do I Find Out about the Newest Treatments for Glioblastoma Multiforme?**

There are several good sources for finding out about the latest in new treatments (clinical trials) for brain tumor patients. Up-to-date clinical trial information is available from the NBTF, the National Cancer Institute, and the Internet.

In addition, *SEARCH*, the NBTF quarterly newsletter, and patient-health professional brain tumor conferences offer information about the aspects of coping with and understanding a brain tumor.



### **Information on Experimental Treatments for Brain Tumors**

- **National Brain Tumor Foundation:**  
1.800.934.CURE or [www.brainumor.org](http://www.brainumor.org)
- **National Cancer Institute:**  
1.800.4.CANCER or  
<http://cancertrials.nci.nih.gov>  
Provides listings of clinical trials and information about different tumor types, treatments, and other helpful information.
- **Clinical Trials Listings:**  
[www.virtualtrials.com](http://www.virtualtrials.com)  
A web page developed by Al Musella, DPM that contains the latest information on brain tumor clinical trials.
- **Medline:** [www.medaccess.com](http://www.medaccess.com)  
A search tool for finding the latest articles about brain tumors published in medical journals. Medline is also available through most medical school libraries as well as public libraries.

## **Being a Survivor— A Message of Hope**

*“It was five years ago when I was diagnosed with a brain tumor and based on statistics given a rather dire prognosis. The irony is I, like others in a similar situation, have come to refer to my disease as a gift because it was a wake-up call. And it was not, ‘Hey, wake up, you’re going to die.’ It was, ‘Hey, wake up, you are alive.’ Wake up and recognize the preciousness of this moment and all the wonderful moments life so generously and graciously gives you.”*

— FIVE-YEAR GLIOBLASTOMA SURVIVOR



**P**atients diagnosed with brain tumors have gone through a very difficult, life-threatening experience—one that often changes people and the way they look at life. Sharing these experiences, including the practical and emotional ups and downs that follow, empowers patients as well as others and is one of the healthiest ways to heal. Family and friends, support groups, meeting other survivors, and counseling are some of the ways that brain tumor patients have learned not only to cope, but also to maintain a positive outlook. As one brain tumor survivor has said, “I have no question that the mind-body connection is very real and can affect the outcome of our illness. I do not intend outcome to be translated as cure, though. Some people will get better and stay better while others will have periods of remission. Whatever time remains—and I base this on my many, many conversations with patients as well as my own experience—it will be higher quality if we engage our mind’s ability to affect our attitude.”

**T**he National Brain Tumor Foundation and a number of other organizations provide useful resources to brain tumor patients, family members and friends, and healthcare professionals. For more information about resources, treatment information, support groups, and other services, please contact:



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the National Brain Tumor Foundation.