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## **Glioma Brain Tumors** **basic level**

### **Overview**

This fact sheet provides a brief overview of glioma tumors. Please see Brain Tumors: An Introduction for more information.

### **What is a glioma?**

A glioma is a type of brain tumor that grows from glial cells. Glial cells support nerve cells with energy and nutrients and help maintain the blood-brain barrier. There are various types of glial cells, each with a different function:

- Astrocyte - transports nutrients and holds neurons in place
- Oligodendrocyte - provides insulation (myelin) to neurons
- Microglia - digests dead neurons and pathogens
- Ependymal cells - line the ventricles and secrete cerebrospinal fluid

Glioma is an umbrella term used to describe the different types of gliomas: astrocytoma, oligodendroglioma, and glioblastoma. Gliomas vary in their aggressiveness, or malignancy. Some are slow-growing and are likely curable. Others are fast-growing, invasive, difficult to treat, and are likely to recur.

### **What are the symptoms?**

Symptoms of a glioma are related to the location of the brain in which they occur and may include headaches, numbness, weakness, personality changes or confusion, and seizures.

### **How is diagnosis made?**

If a patient has symptoms that suggest a glioma, the patient's physician will work with a team of specialists to confirm the diagnosis. A specialist will conduct a neurological examination, followed by CT scans and/or an MRI. These tests will help determine the size, location and type of tumor. The diagnosis can be confirmed by a biopsy.

### **What are the treatment options?**

Treatment options vary depending on the cell type and aggressiveness of the tumor. Gliomas are graded based on the type of glial cell from which they grow. This is determined by a pathologist who examines the tumor cells (obtained in a biopsy) under a microscope.

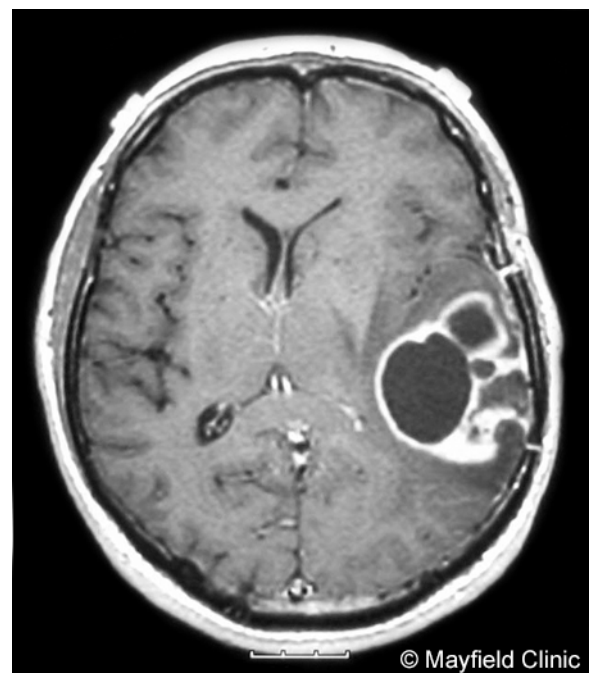
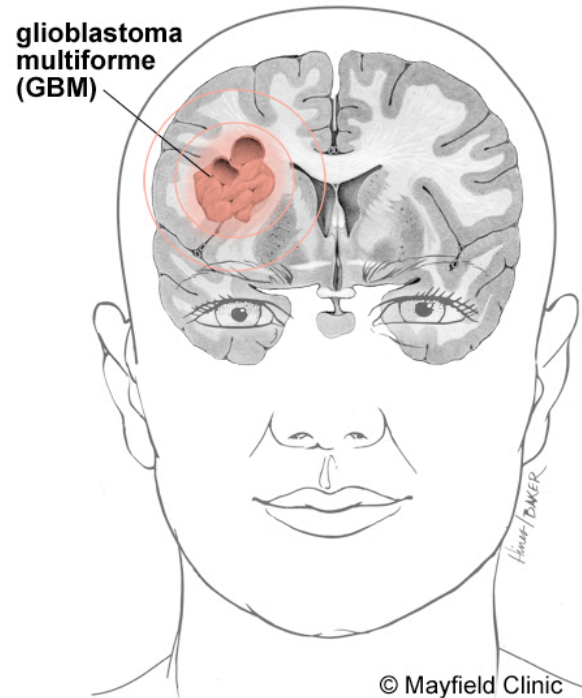


Figure 1. Illustration (top) and MRI (bottom) of a glioblastoma tumor in the parietal lobe.

**Grade I – Pilocytic astrocytoma:** typically occurs in children in the cerebellum or brainstem, and occasionally in the cerebral hemispheres. It can occur in adults, but less commonly. Grade I tumors are slow growing and relatively benign. Treatment options include:

- Observation – for small tumors and tumors located in areas that are not candidates for surgery (brainstem) may be observed and may never grow.
- Surgery – treatment of choice in most cases. Complete removal can be curative.
- Radiation – reserved for tumors that are unable to be surgically removed, residual tumor after surgery, or recurrent tumor.

**Grade II – Low-grade glioma:** includes astrocytoma, oligodendroglioma, and mixed oligoastrocytoma. Grade II gliomas typically occur in young adults (20s - 50s) and are most often found in the cerebral hemispheres. Due to the infiltrative nature of these tumors, recurrences may occur. Some grade II gliomas recur and evolve into more aggressive tumors (grade III or IV). Treatment options include:

- Observation – for tumors located in areas that are not candidates for surgery or high risk to cause loss of function after surgery. Some tumors may never grow, but others will enlarge or transform to a high-grade tumor warranting treatment.
- Surgery – treatment of choice if tumor is able to be removed without causing loss of function. Complete removal can be curative.
- Radiation – can be used either following surgery to slow residual tumor growth or in cases where surgery is not an option.
- Chemotherapy – not typically used except for recurrent or some high-risk tumors.

**Grade III – Malignant glioma:** includes anaplastic astrocytoma, anaplastic oligodendroglioma, and anaplastic mixed oligoastrocytoma. Grade III tumors grow faster and more aggressively than grade II astrocytomas. They invade nearby brain tissue with tentacle-like projections, making complete surgical removal more difficult. Patients often present with seizures, neurologic deficits, headaches, or changes in mental status. Treatment options include:

- Observation – not typically an option due to malignant and rapid growth.
- Surgery – maximal removal of the tumor is recommended if tumor can be removed without causing loss of function.
- Radiation – recommended after surgery with multiple fractions over ~6 weeks.
- Chemotherapy – given after radiation for 6-12 months; temozolomide (Temodar).

## Treatment Glossary

**Surgery:** to surgically remove a brain tumor, a neurosurgeon performs a craniotomy to open the skull (see Craniotomy). Sometimes only part of the tumor is removed if it is near critical areas of the brain. A partial removal can still relieve symptoms. Radiation or chemotherapy may be used on the remaining tumor cells.

**Radiation therapy:** uses controlled high-energy rays to damage the DNA inside cells, making them unable to divide and reproduce. The goal of radiation therapy is to maximize the dose to abnormal cells and minimize exposure to normal cells. There are several ways to deliver radiation (see Radiosurgery & Radiotherapy of the Head), these include:

- Stereotactic radiosurgery (SRS): delivers a high dose of radiation during a single session. Although it is called surgery, no incision is made.
- Fractionated stereotactic radiotherapy (FSR): delivers lower doses of radiation over many visits. Patients return daily over several weeks to receive the complete radiation dose.
- Whole brain radiotherapy (WBRT): delivers the radiation dose to the entire brain. It is often used to treat multiple brain tumors and metastases.
- Radiation seeds (brachytherapy): deliver a low dose of radiation from inside the tumor. After a surgery to remove the tumor, about 50 to 100 radiation seeds are placed inside the surgical cavity. The radiation dose is delivered to the first few millimeters of tissue that surround the tumor cavity where malignant cells may still remain.

**Chemotherapy:** drugs that work by interrupting cell division. Unfortunately, chemotherapy affects not only tumor cells but also normal cells. This causes side effects, especially in fast growing cells (e.g., hair, blood). Chemotherapy can be given orally as a pill, intravenously (IV), or as a wafer placed surgically into the tumor. The drugs most commonly used to treat brain tumors are carmustine (BCNU) and temozolomide (Temodar). Treatment is delivered in cycles with rest periods in between to allow the body to rebuild healthy cells.

- Chemotherapy wafers: can be placed in a surgical cavity after a tumor has been removed. They are about the size of a nickel and are made of a polymer that has been filled with BCNU.

- Clinical trials – due to the aggressive nature of malignant gliomas, new investigative treatments are being developed and tested. These may include new chemotherapy drugs, immunotherapy, vaccines, or combinations. Please check our available clinical trials.
- Recurrence is common for most patients, and typically occurs at the site of the initial tumor, usually within 2 cm. Treatment of recurrences can include additional surgery, radiation, chemotherapy or combinations.

**Grade IV – Glioblastoma multiforme (GBM):** is a malignant glioma. GBM is the most aggressive and most common primary brain tumor. Glioblastoma multiforme usually spreads quickly and invades other parts of the brain, with tentacle-like projections, making complete surgical removal more difficult. It is common for GBMs to recur after initial treatment. Treatment options include:

- Observation – not typically an option due to malignant and rapid growth.
- Surgery – maximal removal of the tumor is recommended if tumor can be removed without causing loss of function. Radiation seeds may be implanted at the time of surgery.
- Radiation – recommended after surgery with multiple fractions over ~6 weeks.
- Chemotherapy – given during and after radiation for 6-12 months; temozolomide (Temodar).
- Clinical trials – due to the aggressive nature of GBM tumors, new investigative treatments are being developed and tested. These may include new chemotherapy drugs, immunotherapy, vaccines, or combinations. Please check our available clinical trials.
- Recurrence is common, and typically occurs at the site of the initial tumor, usually within 2 cm. Treatment of recurrences can include additional surgery, radiation, chemotherapy or combinations.

## Sources & links

If you have more questions, please contact the Mayfield Clinic at 800-325-7787 or 513-221-1100. Additional information is available on the web.

Support groups provides an opportunity for patients and their families to share experiences, receive support, and learn about advances in treatments and medications. Local support groups in the Cincinnati area include:

Wellness Community of Greater Cincinnati, 513-791-4060

Wellness Community of Northern Kentucky, 859-331-5568

Pediatric Brain Tumor Support Group at Cincinnati Children’s Hospital, 513-636-6369

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