PRIMARY BRAIN TUMORS (PBTs) are relatively uncommon, occurring in an estimated 63,000 patients in the United States each year. PBTs evolve from central nervous tissue, making them different from metastatic brain tumors, which originate outside the brain in distant sites, most frequently from primary tumors of the breast, lung, and melanomas. PBTs can be benign or malignant. Regardless of the degree of malignancy, PBTs are associated with significant neurologic signs and symptoms along with the potential for disability and shortened survival.

The most common subgroup of malignant PBTs is the gliomas. Gliomas originate from glial cells, which provide structural and functional support to neurons (see Primary brain and central nervous system tumors). This article reviews the unique characteristics and nursing considerations of the adult patient diagnosed with glioma, with an emphasis on the most common form, glioblastoma.
Getting to know gliomas

An estimated 18,000 cases of gliomas were diagnosed in the United States in 2010, making it the most frequently occurring malignant brain tumor. Gliomas are usually seen in adults over age 60, occurring more frequently in males than females, and are twice as common in Whites as in Blacks.

The incidence of gliomas has increased in the last two decades, largely due to improvements in diagnostic imaging. The lifetime risk of developing a glioma for both sexes and all ethnicities in the United States is less than 1%. However, gliomas are highly fatal, representing 2% of all cancer-related deaths.

The exact mechanism for glioma genesis (the occurrence and subsequent growth of a glioma) is unknown but generally involves specific genetic changes resulting in tumor formation. Ionizing radiation is the only established environmental risk factor for gliomas. Rare genetic syndromes, such as Li-Fraumeni syndrome, neurofibromatosis, tuberous sclerosis, Turcot syndrome, and von Hippel-Lindau syndrome, account for about 5% of gliomas.

The classification of PBTs is organized around the type of progenitor cell they arise from (see Inside the brain). Gliomas include several different tumor types that vary in terms of malignancy grades. Unlike other solid tumors, gliomas don’t metastasize outside the central nervous system, so the tumor-node-metastases staging system isn’t useful.

Instead, gliomas are commonly classified according to World Health Organization (WHO) criteria from 1 to 4, with a Grade 1 glioma being the least aggressive and Grade 4 being the most aggressive.

- Grade 1: pilocytic astrocytoma, ganglioglioma
- Grade 2: oligodendroglioma, oligoastrocytoma, well-differentiated astrocytomas
- Grade 3: anaplastic astrocytoma, anaplastic oligodendroglioma, anaplastic oligoastrocytoma
- Grade 4: glioblastoma

Importantly, lower-grade tumors such as a Grade 2 astrocytoma or a Grade 3 anaplastic astrocytoma can become more malignant, transforming into a Grade 4 tumor (glioblastoma). Astrocytomas that undergo malignant transformation to a higher grade are classified as secondary glioblastoma. They usually develop in patients under age 45.

Grade 4 tumors can also occur spontaneously, without transformation from a lower-grade astrocytoma. These tumors, classified as primary glioblastoma, are often referred to as de novo (without clinical evidence of a preexisting lesion). They account for 60% of all cases of glioblastoma in adults over age 50.

Recognition and diagnosis

Patients with glioblastoma typically present with seizure, headache, focal neurologic deficit (hemiparesis), cognitive deficit (difficulty finding words), or altered mental status. Signs and symptoms can develop slowly or progress quickly. Common signs and symptoms associated with glioblastoma are classified into those associated with increased intracranial pressure (ICP), such as headache, vomiting, decreased level of consciousness, and seizures, and focal neurologic deficits based on the tumor location.

Seizure is the presenting symptom in 30% to 50% of all patients with glioblastoma. Seizure frequency and severity are primarily related to tumor location. If the tumor is located in the cerebral hemispheres, particularly the frontal, temporal, or parietal lobes, seizure risk increases. Patients with tumors involving the brainstem and cerebellum appear to have a reduced risk for seizure.

Approximately 60% of patients with glioblastoma report a headache at some stage of the disease. Headaches may be generalized or localized to the tumor location, and are typically described as dull, nonthrob- bing, and intermittent. Headaches may be associated with increased ICP and be more severe with positional change, coughing, or vomiting, and during sleep and activity.

Alterations in mood, memory, concentration, personality, abstract reasoning, decision making, speech, and sleep/wake cycles are all components of altered mental status. Although patients infrequently have signs and symptoms of altered mental status at the time of diagnosis, the incidence increases with disease progression.

Primary brain and central nervous system tumors

Gliomas account for 32% of all primary brain and central nervous system tumors.
Onset may be acute or insidious and symptom severity fluctuates, particularly during treatment. Specific types of altered mental status are determined by tumor location. In the context of mood and behavioral changes, for example, left-sided and frontal lobe tumors are associated with depression, left anterior lobe tumors with obsession, and temporal lobe tumors with anger, indifference, and disinhibition. See Impact of tumor location on signs and symptoms for more information.

To confirm the presence of a PBT, the most common diagnostic tests are contrast-enhanced computed tomography (CT) scans or magnetic resonance imaging (MRI). MRI is the gold standard because it provides more detail and better visualization of the tumor compared to CT. A biopsy or surgical resection is then done for a definitive diagnosis.

Once tissue is obtained, the tumor type and degree of malignancy can be determined. Glioblastomas are distinguished from lower-grade astrocytomas by increased mitosis, cellular atypia, and necrosis or neovascularization.

**Treating glioblastoma**

The average survival rate for patients with glioblastoma is 14 to 16 months. Treatment usually focuses on increasing patient survival time with a satisfactory quality of life, not on a cure. Patients commonly die from their disease or treatment-related complications. Although treatment has extended life for some patients, neurocognitive changes, worsening of existing neurologic deficits, and treatment-associated symptoms may impair their quality of life.

Regardless of grade, initial treatment of gliomas usually involves surgery to remove the tumor. When tumors invade critical brain structures, the risks of surgical resection may outweigh the benefits and a less-invasive biopsy may be done. The goal of biopsy is to provide the required tissue to determine the diagnosis. The goal of surgical resection is to decrease tumor volume and decompress adjacent brain structures, improving signs and symptoms. Glioblastoma are highly invasive and proliferative tumors that infiltrate into adjacent, healthy tissue. Resection isn’t considered a cure because some of the tumor can remain behind.

Following surgical resection or biopsy, standard treatment for glioblastoma is radiation therapy, chemotherapy, or both.

**Radiation therapy** delivered focally to the tumor is generally administered after surgery for 6 to 7 weeks. Patients typically experience alopecia in the radiation field, fatigue, and worsening of neurologic signs and symptoms during the course of therapy. Less common complications include alterations in hearing and taste, or nausea and vomiting.

**Chemotherapy** is often prescribed concurrently with radiation therapy. The oral chemotherapy drug temozolomide is administered for 6 weeks while the patient also undergoes radiation therapy. After the end of radiation treatment, temozolomide is then administered alone for 6 months to 1 year. Local delivery of the chemotherapy drug carmustine can be achieved with wafers (Gliadel wafers), placed directly in the resection cavity, and may modestly increase the survival rate for patients newly diagnosed with glioblastoma. Bevacizumab is often used to treat recurrent glioblastoma.

Although other treatments such as immunotherapy are evolving, concurrent radiation and chemotherapy (temozolomide), followed by chemotherapy, remain the gold standard to prolong life, slow neurologic impairment, and alleviate the signs and symptoms of glioblastoma.

**Support and educate**

Managing the diagnosis and treatment as well as neurologic complications associated with the tumor are important parts of caring for a patient with glioblastoma. The diagnosis is frightening to the patient and family, and the adjustment and adaptation to cognitive and neurologic impairments can be stressful.
Provide education and emotional support early in the diagnostic process. During the initial perioperative period, educate your patients regarding the tumor type as well as craniotomy wound care and neurologic symptom management. Patients usually undergo comprehensive rehabilitative therapy in the postoperative period. Goals include improving function and compensating for deficits that may be permanent.

Further treatment is usually delayed until 2 weeks after surgery to give the surgical site time to heal. With tumor control or shrinkage, signs and symptoms may improve. During treatment, manage adverse reactions associated with radiation therapy and chemotherapy to maintain the patient's quality of life and tolerance of treatment.

The most common adverse reactions associated with treatment include fatigue, neutropenia, and thrombocytopenia resulting in risk for infection or bleeding, nausea and vomiting, and constipation.17 To combat fatigue, advise patients to maintain pretreatment activity levels and instruct them in good sleep hygiene. Antiemetics may be prescribed for nausea and vomiting. Constipation can be relieved with the addition of fiber supplements or stool softeners; review the importance of adequate hydration.

Teach patients and family members about the signs and symptoms of infection, which in addition to fever and chills, may also include headache and stiff neck in the neuro-oncology patient. Monitor for thrombocytopenia and, if present, advise patients to avoid aspirin and other nonsteroidal antiinflammatory drugs and use an electric shaver and soft toothbrush.

Because of the risk of intracranial hemorrhage in postsurgical patients, emphasize the importance of promptly reporting vision changes, sudden headache, or dizziness.

Most patients also require adjunctive medications, such as antiepileptic drugs to prevent seizures and corticosteroids to control cerebral edema and improve headache, local weakness, and cognitive deficits. Advise patients of potential adverse reactions to these medications, including fatigue, weight gain, mood disturbance, and muscle atrophy.

Physical disability, personality and behavior changes, and impaired decision-making capacity prevent many patients from working, so their financial and insurance status may be compromised.22 Referral to a social worker, financial counselor, or case manager may help patients and caregivers better address financial concerns and plan for continuity of care. Patients with glioblastoma may be restricted from driving and depend on others for transportation. Cognitive and motor deficits can also impair their ability to self-administer medications. Talk with family and caregivers to make sure patients receive the help needed to adhere to the prescribed medication schedule and follow-up care.

The uncertainty of tumor response and potential complications of both the tumor and treatment call for continued nursing assessment and interventions based on the individual patient. Refer patients to rehabilitative services (physical, speech, and occupational therapy) and neuropsychological testing as needed.

Although the prognosis for most patients with glioblastoma is poor, providing comprehensive care and maintaining hope are important to help them maintain a good quality of life. Several resources exist that provide general guidelines for you and your patients. (See Resources on the Web.)

Most patients with glioblastoma ultimately die of the disease, so discuss palliative care with patients and their family and caregivers. Referring patients to hospice provides expert management of end-of-life issues and support to the patient’s caregivers.

### Impact of tumor location on signs and symptoms

<table>
<thead>
<tr>
<th>Tumor location</th>
<th>Signs and symptoms</th>
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| **Frontal lobe** | Right: left-sided weakness (hemiparesis), seizures  
Left: right-sided weakness, aphasia, seizures  
Bifrontal: mood and intellect disturbance |
| **Temporal lobe** | Nondominant: visual-spatial disturbance  
Dominant: receptive aphasia, reduced short-term memory, complex partial seizures |
| **Parietal lobe** | Seizures, sensory loss in half of body opposite lesion  
Dominant: finger agnosia, acalculia (the inability or loss of the ability to perform arithmetic operations), loss of left-right discrimination |
| **Occipital lobe** | Visual loss, visual hallucinations, seizures  
Left: right-sided hemianopsia (loss of visual field)  
Right: left-sided hemianopsia |
| **Cerebellum** | Ataxia, dysarthria, truncal instability  
Left: left-sided incoordination/ataxia  
Right: right-sided incoordination/ataxia |
| **Brainstem** | Cranial nerve deficit, dysphagia, vomiting, motor or sensory tract dysfunction |

### Resources on the Web

- American Association of Neuroscience Nurses: [www.aann.org](http://www.aann.org)
- American Brain Tumor Association: [www.abta.org](http://www.abta.org)
- American Cancer Society: [www.acs.org](http://www.acs.org)
- National Brain Tumor Society: [www.braintumor.org](http://www.braintumor.org)
- Oncology Nursing Society: [www.ons.org](http://www.ons.org)
- American Association of Neuroscience Nurses: [www.aann.org](http://www.aann.org)
- American Brain Tumor Association: [www.abta.org](http://www.abta.org)
- American Cancer Society: [www.acs.org](http://www.acs.org)
- National Brain Tumor Society: [www.braintumor.org](http://www.braintumor.org)
- Oncology Nursing Society: [www.ons.org](http://www.ons.org)
Challenging diagnosis

A diagnosis of glioblastoma is rare, and you may care for only a handful of patients with this disease. But because of the poor prognosis and the neurologic complications that can occur, caring for these patients can be challenging. The key is to provide supportive care throughout the disease progression to improve the quality of the patient’s life.

REFERENCES

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INSTRUCTIONS
Caring for an adult with a malignant primary brain tumor

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