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Brain Tumor - Treatment Options [1]

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ON THIS PAGE: You will learn about the different ways doctors use to treat people with a brain tumor. To see other pages, use the menu on the side of your screen.

This section outlines treatments that are the standard of care (the best known treatments available) for brain tumors. When making treatment plan decisions, patients are also encouraged to consider clinical trials as an option. A clinical trial is a research study to test a new approach to treatment to evaluate whether it is safe, effective, and possibly better than the standard treatment. Clinical trials may test such approaches as a new drug, a new combination of standard treatments, or new doses of current therapies. Your doctor can help you review all treatment options. For more information, see the About Clinical Trials [3] and Latest Research [4] section.

Treatment overview

In brain tumor care, different types of doctors often work together to create a patient's overall treatment plan that combines different types of treatment. This is called a multidisciplinary team [5]. Cancer care teams also include a variety of other health care professionals, including physician assistants, oncology nurses, social workers, pharmacists, counselors, dietitians, and others.

Descriptions of the most common treatment options for a brain tumor are listed below, including treatments that help manage symptoms. Treatment options and recommendations depend on several factors:

- The size, type, and grade of the tumor

- Whether the tumor is putting pressure on vital parts of the brain
- If the tumor has spread to other parts of the CNS or body
- Possible side effects
- The patient's preferences and overall health.

Some types of brain tumors grow rapidly; other tumors grow slowly. Considering all these factors, your doctor will talk with you about how soon treatment should start after diagnosis.

Treatment options include those described below, such as surgery, radiation therapy, and chemotherapy. Your care plan may also include treatment for symptoms and side effects, an important part of your medical care.

For a low-grade brain tumor, surgery may be the only treatment needed especially if all of the tumor can be removed. If there is visible tumor remaining after surgery, radiation and chemotherapy may be used. For higher-grade tumors, treatment usually begins with surgery, followed by radiation therapy and chemotherapy. Your exact treatment plan will be made by your health care team.

Successfully treating brain tumors can be challenging. The body's blood-brain barrier normally protects the brain and spinal cord from harmful chemicals entering those structures through the bloodstream. However, this barrier also keeps out many types of chemotherapy. Surgery can be difficult if the tumor is near a delicate part of the brain or spinal cord. Even when the surgeon can completely remove the original tumor, there may be parts of the tumor remaining that are too small to be seen or removed during surgery. And, radiation therapy can damage healthy tissue.

However, research in the past two decades has helped to significantly lengthen the lives of people with brain tumors. More refined surgeries, a better understanding of the types of tumors that respond to chemotherapy, and more targeted delivery of radiation therapy have lengthened lives and improved the quality of life for many people diagnosed with a brain tumor.

Take time to learn about all of your treatment options and be sure to ask questions about things that are unclear. Also, talk about the goals of each treatment with your doctor and what you can expect while receiving the treatment. Learn more about making treatment decisions [6].

Getting care for symptoms and side effects

A brain tumor and its treatment often cause side effects. In addition to treatment to slow, stop, or eliminate the tumor, an important part of care is relieving a person's symptoms and side

effects. This approach is called palliative or supportive care, and it includes supporting the patient with his or her physical, emotional, and social needs.

Palliative care is any treatment that focuses on reducing symptoms, improving quality of life, and supporting patients and their families. Any person, regardless of age or type and stage of cancer, may receive palliative care. It works best when palliative care is started as early as needed in the treatment process. People often receive treatment for the tumor and treatment to ease side effects at the same time. In fact, patients who receive both often have less severe symptoms, better quality of life, and report they are more satisfied with treatment.

Palliative treatments vary widely and often include medication, nutritional changes, relaxation techniques, emotional support, and other therapies. You may also receive palliative treatments similar to those meant to eliminate the tumor, such as chemotherapy, surgery, or radiation therapy. Talk with your doctor about the goals of each treatment in your treatment plan.

Some of the symptoms of a brain tumor can be severe and have an enormous impact on a patient's life. However, they can often be managed with the use of certain medications. Supportive care for people with a brain tumor includes:

- Drugs called corticosteroids are used to lower swelling in the brain, which can lessen pain from the swelling without the need for prescription pain medications.

- Antiseizure medication to help control seizures. There are several types of drugs available, and they are prescribed by your neurologist.

Before treatment begins, talk with your health care team about the possible side effects of your specific treatment plan and palliative care options. And during and after treatment, be sure to tell your doctor or another health care team member if you are experiencing a problem so it can be addressed as quickly as possible. Learn more about palliative care [7].

Surgery

Surgery is the removal of the tumor and some surrounding healthy tissue during an operation. It is usually the first treatment used for a brain tumor and is often the only treatment needed for a low-grade brain tumor. Removing the tumor can improve neurological symptoms, provide tissue for diagnosis, help make other brain tumor treatments more effective, and, in many instances, improve the prognosis of a person with a brain tumor.

A neurosurgeon is a doctor who specializes in surgery on the brain and spinal column. Surgery to the brain requires the removal of part of the skull, a procedure called a craniotomy. After the surgeon removes the tumor, the patient's own bone will be used to cover the opening in the skull.

There have been rapid advances in surgery for brain tumors, including the use of cortical mapping. This technique allows doctors to identify certain areas of the brain that control the senses, language, and motor skills. In addition, enhanced imaging devices give surgeons more tools to plan and perform surgery. For example, computer-based techniques, such as Image Guided Surgery (IGS), help surgeons map out the location of the tumor very accurately. However, this is a very specialized technique that may not be widely available.

For a tumor that is near the brain's speech center, it is increasingly common to perform the operation when the patient is awake for part of the surgery. Typically, the patient is awakened once the surface of the brain is exposed. Then, special electrical stimulation techniques are used to locate the specific part of the brain that controls speech. This approach can avoid causing damage while removing the tumor.

In addition to removing or reducing the size of the brain tumor, surgery can provide a tissue sample for biopsy analysis, as explained in Diagnosis [8]. For some tumor types, the results of this analysis can help determine if chemotherapy or radiation therapy will be useful. For a cancerous tumor, even if the cancer cannot be cured, removing it can relieve symptoms from the tumor pressing on the brain.

Sometimes, surgery cannot be performed because the tumor is located in a place the surgeon cannot reach or is near a vital structure; these tumors are called inoperable. If the tumor is inoperable, the doctor will recommend other treatment options.

Before surgery, talk with your health care team about the possible side effects and how they will be managed or relieved. Learn more about the basics of surgery [9].

Radiation therapy

Radiation therapy is the use of high-energy x-rays or other particles to destroy cancer cells. Doctors may use radiation therapy to slow or stop the growth of the tumor. It is typically given after surgery and possibly along with chemotherapy. A doctor who specializes in giving radiation therapy to treat a tumor is called a radiation oncologist. The most common type of radiation treatment is called external-beam radiation therapy, which is radiation given from a machine outside the body. When radiation treatment is given using implants, it is called internal radiation therapy or brachytherapy. A radiation therapy regimen (schedule) usually consists of a specific number of treatments given over a set period of time.

External-beam radiation therapy can be directed at the tumor in the following ways:

- **Conventional radiation therapy.** The treatment location is determined based on anatomic landmarks and x-rays. In certain situations, such as whole brain radiation therapy for brain metastases, this technique is appropriate. For more precise targeting, different techniques are needed. The amount of radiation given depends on the tumor's grade.

- **Three-dimensional conformal radiation therapy (3D-CRT).** Using images from CT and MRI scans (see Diagnosis [8]), a three-dimensional model of the tumor and healthy tissue surrounding the tumor is created on a computer. This model can be used to aim the radiation beams directly at the tumor, sparing the healthy tissue from high doses of radiation therapy.

- **Intensity modulated radiation therapy (IMRT).** IMRT is a type of 3D-CRT (see above) that can more directly target a tumor, delivering higher doses of radiation to the tumor while giving less to the surrounding healthy tissue. In IMRT, the radiation beams are broken up into smaller beams and the intensity of each of these smaller beams can be changed. This means that the more intense beams, or the beams giving more radiation, can be directed only at the tumor.

- **Proton therapy.** Proton therapy is a type of external-beam radiation therapy that uses protons rather than x-rays. At high energy, protons can destroy cancer cells. Proton beam therapy is typically used for tumors when less radiation is needed because of the location. This includes tumors that have grown into nearby bone, such as the base of skull, and those near the optic nerve.

- **Stereotactic radiosurgery.** Stereotactic radiosurgery is the use of a single, high dose of radiation given directly to the tumor and not healthy tissue. It works best for a tumor that is only in one area of the brain and certain noncancerous tumors, but it can also be used when a person has more than one metastatic brain tumor. There are many different types of stereotactic radiosurgery equipment, including:

    - A modified linear accelerator is a machine that creates high-energy radiation by using electricity to form a stream of fast-moving subatomic particles.

    - A gamma knife is another form of radiation therapy that concentrates highly focused beams of gamma radiation on the tumor.

    - A cyber knife is a robotic device used in radiation therapy to guide radiation to the tumor target—particularly in the brain, head, and neck regions.

- **Fractionated stereotactic radiation therapy.** Radiation therapy is delivered with stereotactic precision but divided into small daily doses called fractions given over several weeks, in contrast to the one-day radiosurgery. This technique is used for tumors located close to sensitive structures, such as the optic nerves or brain stem.

With these different techniques, doctors are trying to be more precise and reduce radiation exposure to the surrounding healthy brain tissue. Depending on the size and location of the tumor, the radiation oncologist may choose any of the above radiation techniques. In certain situations, a combination of two or more techniques may work best.

Short-term side effects from radiation therapy may include fatigue, mild skin reactions, hair loss, upset stomach, and neurologic symptoms. Most side effects go away soon after treatment is finished. Also, radiation therapy is usually not recommended for children younger than five because of the high risk of damage to their developing brains. Longer term side effects of radiation depend on how much healthy tissue received radiation therapy and include memory and hormonal problems and cognitive (thought process) changes, such as difficulty understanding and performing complex tasks.

Learn more about the basics of radiation therapy [10] on this website, or see the American Society for Therapeutic Radiology and Oncology's pamphlet, Radiation Therapy for Brain Tumors [11].

Chemotherapy

Chemotherapy is the use of drugs to destroy cancer cells, usually by stopping the cancer cells' ability to grow and divide. The goal of chemotherapy can be to destroy cancer cells remaining after surgery, slow a tumor's growth, or reduce symptoms. Chemotherapy is given by a medical oncologist, a doctor who specializes in treating tumors with medication, or a neuro-oncologist.

Systemic chemotherapy gets into the bloodstream to reach cancer cells throughout the body. Common ways to give chemotherapy include a pill or capsule that is swallowed (orally) or by intravenous (IV) injection placed into a vein using a needle, through a catheter or port [12], which are used to make injections easier.

As explained above, chemotherapy to treat a brain tumor is typically given after surgery and possibly along with radiation therapy or after radiation therapy, particularly if the tumor has come back after initial treatment.

A chemotherapy regimen (schedule) usually consists of a specific number of cycles given over a set period of time. A patient may receive one drug at a time or combinations of different drugs at the same time.

Some drugs are better at going through the blood-brain barrier, and these drugs are often used for a brain tumor because of this ability.

- Gliadel wafers are one way to give the drug carmustine, which involves placing the wafers in the area where the tumor was removed during surgery.

- For people with glioblastoma, the latest standard of care is radiation therapy with daily low-dose temozolomide (Temodar), followed by monthly doses of temozolomide after radiation therapy for six months to one year.

- A combination of three drugs, lomustine (Gleostine), procarbazine (Matulane), and vincristine (Vincasar) have been used along with radiation therapy. This approach has helped lengthen the lives of patients with grade III oligodendroglioma with a 1p19q co-deletion (see Biogenetic markers in the Grades and Prognostic Factors [13] section) when given either before or right after radiation therapy. It has also been shown to lengthen lives of patients when given after radiation therapy for low-grade tumors that could not be completely removed with surgery. Clinical trials on the use of chemotherapy to delay radiation therapy in patients with low-grade glioma are also ongoing.

Patients are monitored with a brain MRI every two to three months while receiving active treatment. Then, the length of time between MRI scans increases depending on the tumor's grade. Patients often have regular MRIs to monitor their health even once treatment is finished and the tumor has not grown. If the tumor grows during treatment, other treatment options will be considered.

The side effects of chemotherapy depend on the individual and the dose used, but they can include fatigue, risk of infection, nausea and vomiting, hair loss, loss of appetite and diarrhea. These side effects usually go away once treatment is finished. Rarely, certain drugs may cause some hearing loss. Others may cause kidney damage. Patients may be given extra fluid by IV to protect their kidneys.

Learn more about the basics of chemotherapy [14] and preparing for treatment [15]. The medications used to treat cancer are continually being evaluated. Talking with your doctor is often the best way to learn about the medications prescribed for you, their purpose, and their potential side effects or interactions with other medications. Learn more about your prescriptions by using searchable drug databases [16].

Targeted therapy

In addition to standard chemotherapy, targeted therapy is a treatment that targets the tumor's specific genes, proteins, or the tissue environment that contributes to cancer growth and survival. This type of treatment blocks the growth and spread of tumor cells while limiting the damage to healthy cells.

Recent studies show that not all tumors have the same targets, and some tumors may have more than one target. To find the most effective treatment, your doctor may run tests to identify the genes, proteins, and other factors in your tumor. This helps doctors better match each patient with the most effective treatment whenever possible. In addition, many research studies are taking place now to find out more about specific molecular targets and new treatments

directed at them. Learn more about the basics of targeted treatments [17].

For a brain tumor, anti-angiogenesis therapy [18] is one type of targeted therapy used, and others are being researched. It is focused on stopping angiogenesis, which is the process of making new blood vessels. Because a tumor needs the nutrients delivered by blood vessels to grow and spread, the goal of anti-angiogenesis therapies is to “starve” the tumor. Bevacizumab (Avastin) is an anti-angiogenesis therapy used to treat glioblastoma multiforme when prior treatment has not worked. Talk with your doctor about possible side effects for a specific medication and how they can be managed.

Alternating electric field therapy (tumor treating fields)

In 2011, the FDA approved a new noninvasive portable device for the treatment of recurrent glioblastoma. This device interferes with parts of a cell that are needed for the tumor cells to grow and spread. It is given by placing electrodes that produce an electric field on the outside of a person’s head. In one study comparing this device with chemotherapy, researchers found that patients who used the device lived as long as those who received chemotherapy. In addition, they had fewer side effects.

Remission and the chance of recurrence

A remission is when the tumor cannot be detected in the body. A remission can be temporary or permanent.

For most primary brain tumors, despite imaging tests showing that the tumor growth is controlled or there are no visible signs of a tumor, it is common for a brain tumor to recur.

Patients will often continue to receive MRI scans to watch for a recurrence. This uncertainty causes many people to worry that the tumor will come back. It is important to talk with your doctor about the possibility of the tumor returning. Understanding your risk of recurrence and the treatment options may help you feel more prepared if the tumor does return. Learn more about coping with the fear of recurrence [19].

If the tumor does return after the original treatment, it is called a recurrent tumor. A recurrent brain tumor generally comes back near where it originally started. Rarely, it may come back in another place, called multifocal.

When this occurs, a cycle of testing will begin again to learn as much as possible about the recurrence. After testing is done, you and your doctor will talk about your treatment options. Often the treatment plan will include the treatments described above such as surgery, radiation therapy, chemotherapy, and targeted therapy, but they may be used in a different combination or given at a different pace. Temozolomide has been approved to treat Grade III recurrent tumors. Bevacizumab (see above) may also be used for a recurrent tumor. In addition, alternating electric field therapy may be used for patients with recurrent high-grade glioma.

There is no single approach to treating a recurrent brain tumor, and your treatment plan will be based on many factors. Whichever treatment plan you choose, palliative care will be important for relieving symptoms and side effects. Your doctor may suggest clinical trials of new drugs that are being created and tested to treat brain tumors that may help with recurrent tumors. Many of these new drugs are called "molecularly targeted therapies" because they are small in size, which means they can be taken by mouth, and/or can target specific parts of the brain tumor cells. These new drugs are being tested either alone or in combination with standard chemotherapy. Learn more about clinical trials on brain tumor treatment in the Latest Research [4] section.

People with recurrent cancer often experience emotions such as disbelief or fear. For most patients, a diagnosis of a recurrent brain tumor is very stressful and, at times, difficult to bear. Patients and their families are encouraged to talk about the way they are feeling with doctors, nurses, social workers, or other members of the health care team and to ask about support services to help them cope. It may also be helpful to talk with other patients, including through a support group. Learn more about dealing with cancer recurrence [20].

If treatment fails

Recovery from a brain tumor is not always possible. If the tumor cannot be cured or controlled, the disease may be called advanced or terminal.

This diagnosis is stressful, and an advanced brain tumor is difficult to discuss for many people. However, it is important to have open and honest conversations with your doctor and health care team to express your feelings, preferences, and concerns. The health care team is there to help, and many team members have special skills, experience, and knowledge to support patients and their families. Making sure a person is physically comfortable and free from pain is extremely important.

Patients who have an advanced brain tumor and who are expected to live less than six months may want to consider a type of palliative care called hospice care. Hospice care is designed to provide the best possible quality of life for people who are near the end of life. You and your family are encouraged to think about where you would be most comfortable: at home, in the hospital, or in a hospice environment. Nursing care and special equipment can make staying at home a workable alternative for many families. Learn more about advanced care planning [21].

After the death of a loved one, many people need support to help them cope with the loss. Learn more about grief and loss [22].

The next section in this guide is About Clinical Trials [3] and it offers more information about research studies that are focused on finding better ways to care for people with cancer. Or, use the menu on the side of your screen to choose another section to continue reading this guide.

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