Brain Tumors



A brain tumor is a collection of abnormal cells that grows in or around the brain. It poses a risk to the healthy brain by either invading or destroying normal brain tissue or by compressing and displacing the brain. Since the brain is enclosed inside the skull which has a fixed amount of space, a growing brain tumor can cause significant damage to the brain. Brain tumors can be malignant (also called brain cancer) or benign (do not contain cancer cells). They may be primary (beginning within the brain) or metastatic (cancer cells elsewhere in the body travel to the brain). Some of these tumors can spread and involve the spinal cord — an extension of the brain.

Your doctor may order head or spine MRI, brain fMRI, head CT, head PET, cerebral angiography, myelography, biopsy or lumbar puncture to help diagnose and evaluate your condition. Other imaging tests may be performed if your doctor suspects your tumor has spread to other parts of your body. Treatment will depend on the size and type of the tumor, its growth rate and your general health. Options include surgery, radiation therapy, chemotherapy, targeted biological therapy or a combination thereof.

What is a brain tumor?

A brain tumor (http://www.radiologyinfo.org) is a collection of abnormal cells that grows in or around the brain. Tumors can directly destroy healthy brain cells by invading them. They can also indirectly damage healthy cells by crowding other parts of the brain and causing inflammation, brain swelling and pressure within the skull.

Brain tumors are either malignant (http://www.radiologyinfo.org) or benign (http://www.radiologyinfo.org) . A malignant tumor, also called brain cancer, usually grows rapidly and often invades or crowds healthy areas of the brain. These tumors also steal the blood supply of a normal brain. Benign brain tumors do not contain cancer cells and are usually slow growing.

Malignant brain tumors fall into two different categories: primary (http://www.radiologyinfo.org) or metastatic (http://www.radiologyinfo.org) . Primary brain tumors begin within the brain. A metastatic tumor is formed when cancer cells located elsewhere in the body break away and travel to the brain. For this reason, metastatic brain tumors are almost always malignant, while primary brain tumors may be benign or malignant.

Brain tumors are classified based on where the tumor is located, the type of tissue involved, whether the tumor is benign or malignant, and other factors. If a tumor is determined malignant, the tumor cells are examined under a microscope to determine how malignant they are. Markers that reflect genetic mutations (gene defects) which can predict tumor behavior and their response to therapy are now tested for routinely. Based on this analysis, tumors are rated, or graded, by their level of malignancy from least to most malignant. Factors that determine the tumor grade include how fast the cells are growing, how much blood is supplying the cells, the presence of dead cells in the middle of the tumor (necrosis (http://www.radiologyinfo.org)), if the cells are confined to a specific area, and how similar the cancerous cells are to normal cells. Many of these tumor characteristics can also be predicted by their appearance on various imaging tests. The cause of primary brain tumors is unknown. Environmental and genetic factors may cause some brain tumors. Prior exposure to radiation therapy as a child seems to be a contributing cause in very few patients.

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Brain tumor symptoms may include:

- Headaches
- Nausea
- Vomiting
- Seizures
- Behavior changes
- Memory loss
- Vision or hearing problems

How is a brain tumor diagnosed and evaluated?

To diagnose and evaluate a brain tumor, your physician may order one of the following imaging tests:

- *MRI of the head (https://www.radiologyinfo.org/en/info/mri-brain) :* Magnetic resonance imaging (MRI) uses a powerful magnetic field, radio frequency pulses and a computer to produce detailed pictures of organs, soft tissues, bone and virtually all other internal body structures. MRI provides detailed images that can detect brain abnormalities such as tumors and infection. MRI has high sensitivity for detecting tumors and evaluating the surrounding area to define extent. *See the MRI Safety (https://www.radiologyinfo.org/en/info/safety-mr) page for more information.*
- *Spine MRI (https://www.radiologyinfo.org/en/info/spinemr) :* Much like MRI of the head, spine MRI uses a powerful magnetic field, radio frequency pulses and a computer to show the anatomy of the vertebrae (http://www.radiologyinfo.org) that make up the spine, as well as the disks, spinal cord and the spaces between the vertebrae through which nerves pass. It can be used to detect tumors that arise in, or spread to, the spine and/or the spinal cord or the fluid that surrounds it (cerebrospinal fluid).
- *Brain fMRI: (https://www.radiologyinfo.org/en/info/fmribrain)* Functional magnetic resonance imaging (fMRI) uses MR imaging to measure the tiny metabolic changes that take place in an active part of the brain. In the case of brain tumor diagnosis, this test is performed to evaluate areas in the brain related to language and muscle movement. It is also used to monitor the growth and function of tumors and assess the potential risks of surgery or other invasive treatments. This test complements the structural details from the MRI with information about how well the brain cells are functioning.
- *CT of the head: (https://www.radiologyinfo.org/en/info/headct)* Computed tomography (CT) scanning combines special x-ray equipment with sophisticated computers to produce multiple images or pictures of the inside of the body. It can detect brain tumors as well as help plan radiation therapy if that is the treatment of choice. CT can also show bleeding or swelling in the brain. *See the Safety page (https://www.radiologyinfo.org/en/info/safety-radiation) for more information on CT.*
- PET and PET/CT (https://www.radiologyinfo.org/en/info/pet) of the head: A positron emission tomography (PET) scan is a diagnostic examination that uses a small amount of radioactive material (called a radiotracer) to diagnose and determine the severity of a variety of diseases. A combined PET/CT exam fuses images from a PET and CT scan together to provide detail on both the anatomy (from the CT scan) and function (from the PET scan) of the brain. This test can measure how a brain tumor utilizes glucose (http://www.radiologyinfo.org) . Other radio-labeled tracers are also being explored to image low-oxygen regions within the tumor.
- *Cerebral angiography (https://www.radiologyinfo.org/en/info/angiocerebral) :* This minimally invasive test uses x-rays and an iodine-containing contrast material to produce pictures of blood vessels in the brain. It can provide additional information on abnormalities seen on MRI or CT of the head, such as the blood supply to a tumor and how the tumor is distorting normal vessels. Cerebral angiography can serve as a valuable roadmap to surgeons and reduce the risks of surgery. It does require the use of a catheter, and it does have potential risk.
- Myelography (http://www.radiologyinfo.org) : This examination uses a real-time form of x-ray called fluoroscopy (http://www.radiologyinfo.org) to introduce a spinal needle into the spinal canal and inject contrast material into the space around the spinal cord (http://www.radiologyinfo.org) and nerve roots (the subarachnoid space (http://www.radiologyinfo.org)), which contains cerebrospinal fluid (http://www.radiologyinfo.org) . It can be used to assess tumors involving the bony spine, meninges, nerve roots or spinal cord when MR imaging cannot be performed, or in addition to MRI.

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- *Biopsy (https://www.radiologyinfo.org/en/info/biopgen) :* A biopsy is the removal of tissue in order to examine it for disease. Often, the tissue is removed by placing a needle through the skin (percutaneously) to the area of abnormality. Biopsies can be safely performed with imaging guidance (such as ultrasound, x-ray, CT, or MRI) to determine exactly where to place the needle and perform the biopsy.
- *Lumbar puncture (https://www.radiologyinfo.org/en/info/spinaltap) :* Also known as a spinal tap, this is a minimally invasive, image-guided diagnostic test that involves the removal of a small amount of cerebrospinal fluid (http://www.radiologyinfo.org) —the fluid that surrounds the brain and spinal cord—or an injection of medication or other substance into the lumbar (http://www.radiologyinfo.org) (or lower) region of the spinal column.
- Other imaging tests may be performed if your physician suspects that your brain tumor has metastasized (spread) to other parts of your body. CT of the chest and abdomen may be done if it is suspected that a brain mass may be metastatic, rather than a primary tumor, to look for the source of tumor. Common sites are the lung and kidney.

Other non-imaging tests include:

- Neurological exam: A physician may perform this exam to check your balance, reflexes, coordination and other senses such as hearing and vision.

How is a brain tumor treated?

The type of treatment recommended depends on the size and type of the tumor, its growth rate and the general health of the patient. Treatment options include:

- Surgery: Also called surgical resection, surgery is often indicated for primary brain tumors. A surgeon removes all or some of the tumor without causing severe damage to surrounding tissues. Surgery may also be used to reduce pressure within the skull (called intracranial pressure (http://www.radiologyinfo.org)) and to relieve symptoms (called palliative treatment (http://www.radiologyinfo.org)) in cases where the tumor cannot be removed.
- Radiation therapy: Conventional radiation therapy uses external beams of x-rays, gamma rays or protons aimed at the tumor to kill cancer cells and shrink brain tumors. The therapy may be delivered in one or more treatments over a period of several weeks. Modern radiation therapy is often performed with imaging guidance and includes arc therapy, *intensity-modulated radiation therapy (IMRT), (https://www.radiologyinfo.org/en/info/imrt)* three-dimensional conformal radiotherapy, *stereotactic radiosurgery, (https://www.radiologyinfo.org/en/info/stereotactic)* and *brachytherapy. (https://www.radiologyinfo.org/en/info/brachy)*
- Chemotherapy (http://www.radiologyinfo.org) : Chemotherapy, or anticancer medications, may be recommended. Chemotherapy, along with radiation (concurrent therapy), has become the standard of care for primary malignant brain tumors. The use of these drugs to slow down or kill rapidly dividing cells can be used before, during or after surgery and/or radiotherapy to help destroy tumor cells and help prevent them from returning. Chemotherapy drugs may be delivered orally or by injection and are often used in combination with radiation therapy. Drugs called radiosensitizers, which are believed to make radiation therapy more effective, may also be prescribed.
- Targeted biological therapy: Also called biotherapy or immunotherapy, targeted biological therapy is a treatment that uses the body's immune system to fight cancer. This type of therapy depends on the identification of markers on the surface of tumor cells.
- A combination of treatment options may include any of the above options.

See the Brain Tumor Treatment (https://www.radiologyinfo.org/en/info/thera-brain) page for more information.

Which test, procedure, or treatment is best for me?

- *Acute Mental Status Change, Delirium, and New Onset Psychosis (https://www.radiologyinfo.org/en/info/acs-acute-mental-status-change-delirium-psychosis)*

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