Brain and Spinal Cord Tumor in Adults Early Detection, Diagnosis, and Staging

Detection and Diagnosis

Catching tumors early often allows for more treatment options. Some early tumors may have signs and symptoms that can be noticed, but this is not always the case.

- Can Brain and Spinal Cord Tumors in Adults Be Found Early?
- Signs and Symptoms of Adult Brain and Spinal Cord Tumors
- Tests for Brain and Spinal Cord Tumors in Adults

Factors Affecting Outlook (Prognosis)

After a brain or spinal cord tumor diagnosis, certain factors can provide important information about the anticipated response to treatment.

- Brain and Spinal Cord Tumors in Adults: Prognostic Factors
- Survival Rates for Selected Adult Brain and Spinal Cord Tumors

Questions to Ask About Adult Brain and Spinal Cord Tumors

Here are some questions you can ask your treatment team to help you better understand your diagnosis and treatment options.

- Questions to Ask About Adult Brain and Spinal Cord Tumors

Can Brain and Spinal Cord Tumors in Adults Be Found Early?

At this time there are no widely recommended tests to screen for brain and spinal cord tumors. (Screening is testing for a disease in people who have no symptoms.) Most brain tumors are found when a person goes to a doctor because of signs or symptoms they are having.

Most often, the outlook for people with a brain or spinal cord tumor depends on their age, the type of tumor, and its location, not by how early it is detected. But as with any disease, earlier detection and treatment is likely to be helpful.

People with inherited syndromes

For people with certain inherited syndromes[1] (such as neurofibromatosis or tuberous sclerosis) that put them at higher risk for brain tumors, doctors often recommend frequent physical exams and other tests starting when they are young. In some cases these tests can find tumors when they are still small. Not all tumors related to these syndromes may need to be treated right away, but finding them early might help doctors monitor them so that they can be treated quickly if they begin to grow or cause problems.

Hyperlinks

1. www.cancer.org/cancer/brain-spinal-cord-tumors-adults/causes-risks-prevention/risk-factors.html

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Signs and Symptoms of Adult Brain and Spinal Cord Tumors

Many different types of tumors can start in the brain or spinal cord. These tumors might cause different signs and symptoms, depending on where they are and how fast they are growing.

Signs and symptoms of brain or spinal cord tumors may develop gradually and become worse over time, or they can happen suddenly, such as with a seizure.

General symptoms

Tumors in any part of the brain might increase the pressure inside the skull (known as **intracranial pressure**). This can be caused by growth of the tumor itself, swelling in the brain, or blockage of the flow of cerebrospinal fluid (CSF). Increased pressure can lead to general symptoms such as:

- **Headache**
- **Nausea**
- **Vomiting**
- **Blurred vision**
- **Balance problems**

- **Personality or behavior changes**
- **Seizures**
- **Drowsiness or even coma**

Headaches that tend to get worse over time are a common symptom of brain tumors, occurring in about half of patients. (Of course, most headaches are not caused by tumors.)

As many as half of people with brain tumors will have **seizures** at some point. The type of seizure may depend on where the tumor is. Sometimes this is the first sign of a brain tumor, but fewer than 1 in 10 first seizures are caused by brain tumors.

Symptoms of tumors in different parts of the brain or spinal cord

Tumors in different parts of the brain or spinal cord can cause different symptoms. But these symptoms can be caused by any abnormality in that particular location — they do not always mean a person has a brain or spinal cord tumor.

- Tumors in the parts of the cerebrum (the large, outer part of the brain) that control movement or sensation can cause **weakness or numbness** of part of the body, often on just one side.
- Tumors in or near the parts of the cerebrum responsible for language can cause **problems with speech or even understanding words**.
- Tumors in the front part of the cerebrum can sometimes affect **thinking, personality, and language**.
- If the tumor is in the cerebellum (the lower, back part of the brain that controls coordination), a person might have **trouble walking; trouble with precise movements of hands, arms, feet, and legs; problems swallowing or synchronizing eye movements;** and **changes in speech rhythm**.
- Tumors in the back part of the cerebrum, or around the pituitary gland, the optic nerve, or certain other cranial nerves can cause **vision problems**.
- Tumors in or near other cranial nerves might lead to **hearing loss** (in one or both ears), **balance problems, weakness of some facial muscles, facial numbness or pain,** or **trouble swallowing**.
- Spinal cord tumors can cause **numbness, weakness,** or **lack of coordination in the arms and/or legs** (usually on both sides of the body), as well as **bladder or bowel problems**.

The brain also controls functions of some other organs, including hormone production, so brain tumors can also cause many other symptoms not listed here.

Having one or more of the symptoms above does not necessarily mean that you have a brain or spinal cord tumor. All of these symptoms can have other causes. Still, if you have any of these symptoms, especially if they don't go away or get worse over time, see your doctor so the cause can be found and treated, if needed.

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Tests for Brain and Spinal Cord Tumors in Adults

Brain and spinal cord tumors are usually found because of signs or symptoms a person is having. If a tumor is suspected, tests will be needed to confirm the diagnosis.

Medical history and physical exam

If signs or symptoms suggest you might have a brain or spinal cord tumor, your doctor

will ask about your medical history, focusing on your symptoms and when they began. The doctor will also check your brain and spinal cord function by testing things like your reflexes, muscle strength, vision, eye and mouth movement, coordination, balance, and alertness.

If the results of the exam are abnormal, you may be referred to a **neurologist** (a doctor who specializes in medical treatment of nervous system diseases) or a **neurosurgeon**(a doctor who specializes in surgical treatment of nervous system diseases), who will do a more detailed neurologic exam and may order other tests.

Imaging tests

Your doctor may order one or more imaging tests. These tests use x-rays, strong magnets, or radioactive substances to create pictures of the brain and spinal cord.

Magnetic resonance imaging (MRI) and computed tomography (CT) scans are used most often to look for brain diseases. These scans will almost always show a brain tumor, if one is present. Doctors can often also get an idea about what type of tumor it might be, based on how it looks on the scan and where it is in the brain.

Magnetic resonance imaging (MRI) scan

MRI scans[1] are very good for looking at the brain and spinal cord and are considered the best way to look for tumors in these areas. The images they provide are usually more detailed than those from CT scans (described below). But they do not pick up the bones of the skull as well as CT scans and therefore may not show the effects of tumors on the skull.

MRI scans use radio waves and strong magnets (instead of x-rays) to make pictures. A contrast material called **gadolinium**may be injected into a vein before the scan to help see details better.

Special types of MRI can be useful in some situations:

Magnetic resonance angiography (MRA) and magnetic resonance venography (MRV): These special types of MRI may be used to look at the blood vessels in the brain. This can be very useful before surgery[2] to help the surgeon plan an operation.

Magnetic resonance spectroscopy (MRS): This test can be done as part of an MRI. It measures biochemical changes in an area of the brain (displayed in graph-like results called **spectra**, although basic images can also be created). By comparing the results

for a tumor to that of normal brain tissue, it can sometimes help determine the type of tumor (or how quickly it is likely to grow), although a biopsy of the tumor is often still needed to get an accurate diagnosis. MRS can also be used after treatment to help determine if an area that still looks abnormal on another test is remaining tumor or if it is more likely to be scar tissue.

Magnetic resonance perfusion: For this test, also known as **perfusion MRI,** a contrast dye is injected quickly into a vein. A special type of MR image is then obtained to look at the amount of blood going through different parts of the brain and tumor. Tumors often have a bigger blood supply than normal areas of the brain. A faster growing tumor may need more blood.

Perfusion MRI can give doctors an idea of the best place to take a biopsy. It can also be used after treatment to help determine if an area that still looks abnormal is remaining tumor or if it is more likely to be scar tissue.

Functional MRI (fMRI): This test looks for tiny blood flow changes in an active part of the brain. It can be used to determine what part of the brain handles a function such as speech, thought, sensation, or movement. Doctors can use this to help determine which parts of the brain to avoid when planning surgery[3] or radiation therapy[4].

This test is similar to a standard MRI, except that you will be asked to do specific tasks (such as answering simple questions or moving your fingers) while the scans are being done.

Computed tomography (CT) scan

A CT scan[5] uses x-rays to make detailed cross-sectional images of your brain and spinal cord (or other parts of the body). Unlike a regular x-ray, a CT scan creates detailed images of the soft tissues in the body.

CT scans are not used as often as MRI scans when looking at brain or spinal cord tumors, but they can be useful in some cases. They may be used if MRI is not an option (such as in people who are very overweight or people who have a fear of enclosed spaces). CT scans also show greater detail of the bone structures near the tumor.

As with MRI, you may get an injection of a contrast dye through an IV (intravenous) line before the scan (although a different dye is used for CT scans). This helps better outline any tumors that are present.

CT angiography (CTA): For this test, you are injected with a contrast material through an IV line while you are in the CT scanner. The scan creates detailed images of the

blood vessels in the brain, which can help doctors plan surgery. CT angiography can provide better details of the blood vessels in and around a tumor than MR angiography in some cases.

Positron emission tomography (PET) scan

For a PET scan[6], you are injected with a slightly radioactive substance (usually a type of sugar known as **FDG**) which collects mainly in tumor cells. A special camera is then used to create a picture of areas of radioactivity in the body. The picture is not as detailed as a CT or MRI scan, but it can provide helpful information about whether abnormal areas seen on other tests (such as MRIs) are likely to be tumors or not. This test is more likely to be helpful for fast-growing (high-grade tumors) than for slower-growing tumors.

This test is also useful after treatment to help determine if an area that still looks abnormal on an MRI scan is remaining tumor or if it is more likely to be scar tissue. Remaining tumor might show up on the PET scan, while scar tissue will not.

Chest x-ray

A chest x-ray might be done to look for tumors in the lungs if a tumor is found in the brain. This is because in adults, most tumors in the brain actually have started in another organ (most often the lung) and then spread to the brain. This test can be done in a doctor's office, in an outpatient radiology center, or in a hospital.

Brain or spinal cord tumor biopsy

Imaging tests such as MRI and CT scans may show an abnormal area that is likely to be a brain or spinal cord tumor. But these scans can't always tell exactly what type of tumor it is. Often this can only be done by removing some of the tumor tissue in a procedure called a **biopsy**. A biopsy may be done as a procedure on its own, or it may be part of surgery[7] to remove the tumor.

Sometimes, a tumor may look so characteristically obvious on an MRI scan (for example, clearly looking like an astrocytoma) that a biopsy is not needed, especially if the tumor is in a part of the brain that would make it hard to biopsy (such as the brain stem). In rare cases a PET scan or MR spectroscopy may give enough information so that a biopsy is not needed.

The 2 main types of biopsies for brain tumors are:

Stereotactic (needle) biopsy

This type of biopsy may be used if, based on imaging tests, surgery to remove the tumor might be too risky (such as with some tumors in vital areas, those deep within the brain, or other tumors that probably can't be removed safely with surgery) but a sample is still needed to make a diagnosis.

The patient may be asleep (under general anesthesia) or awake during the biopsy. If the patient is awake, the neurosurgeon injects a local anesthetic into areas of skin above the skull to numb them. (The skull and brain do not feel pain.)

The biopsy itself can be done in two main ways:

- One approach is to get an MRI or CT, and then use either markers (each about the size of a nickel) placed on different parts of the scalp, or facial and scalp contours, to create a map of the inside of the head. An incision (cut) is then made in the scalp, and a small hole is drilled in the skull. An image-guidance system is then used to direct a hollow needle into the tumor to remove small pieces of tissue.
- In an approach that's being used less often, a rigid frame is attached to the head. An MRI or CT scan is often used along with the frame to help the neurosurgeon guide a hollow needle into the tumor. This also requires an incision in the scalp and a small hole in the skull.

The removed tissue is sent to a pathologist (a doctor specializing in diagnosis of diseases by lab tests). Sometimes it might need to be looked at by a neuropathologist, a pathologist who specializes in nervous system diseases. The pathologist looks at it under a microscope (and might do other lab tests) to determine if the tumor is benign or malignant (cancerous) and exactly what type of tumor it is. This is very important in determining a person's prognosis (outlook) and the best course of treatment[8]. A preliminary diagnosis might be available the same day, although it often takes at least a few days to get a final diagnosis.

Surgical or open biopsy (craniotomy)

If imaging tests show the tumor can likely be treated with surgery, the neurosurgeon may not do a needle biopsy. Instead, he or she may do an operation called a **craniotomy** (described in Surgery for Adult Brain and Spinal Cord Tumors[9]) to remove all or most of the tumor. (If removing **all** of the tumor would likely damage nearby important structures, removing most of the tumor, known as **debulking**, might be done.)

For a preliminary diagnosis, small samples of the tumor are looked at right away by the pathologist while the patient is still in the operating room. This can help guide treatment, including whether further surgery should be done at that time. A final diagnosis is made within a few days in most cases.

You can read more about the kinds of tests done on biopsy or tissue samples in Testing Biopsy and Cytology Specimens for Cancer[10].

Lab tests of biopsy specimens

Finding out which type of tumor someone has is very important in helping to determine their outlook (prognosis) and treatment options. But in recent years, doctors have found that changes in certain genes, chromosomes, or proteins within the cancer cells can also be important. Some tumors are now tested for these types of changes. For example:

- Gliomas that are found to have ***IDH1 or IDH2 gene mutations*** tend to have a better outlook than gliomas without these gene mutations.
- In high-grade gliomas, the presence of **MGMT promoter methylation** is linked with better outcomes and a higher likelihood of responding to chemotherapy.

Lab tests looking for other gene or chromosome changes[11] might also be done.

Lumbar puncture (spinal tap)

This test is used mainly to look for cancer cells in the cerebrospinal fluid (CSF), the liquid that surrounds the brain and spinal cord. For this test, you lie on your side on a bed or exam table with your knees up near your chest. The doctor first numbs an area in the lower part of the back near the spine. A small, hollow needle is then placed between the bones of the spine to withdraw some of the fluid.

This fluid is sent to a lab to be looked at for cancer cells. Other tests may be done on the fluid as well.

Lumbar punctures are usually very safe, but doctors have to make sure the test does not result in a large drop in fluid pressure inside the skull, which could possibly cause serious problems. For this reason, imaging tests such as CT or MRI scans are done first.

Lumbar punctures usually aren’t done to diagnose brain tumors, but they may be done

to help determine the extent of a tumor by looking for cancer cells in the CSF. They are often used if a tumor has already been diagnosed as a type that can commonly spread through the CSF, such as an ependymoma. Lumbar punctures are particularly important in people with suspected brain lymphomas because lymphoma cells often spread into the CSF.

Blood and urine tests

These lab tests rarely are part of the actual diagnosis of brain and spinal cord tumors, but they may be done to check how well the liver, kidneys, and some other organs are working. This is especially important before any planned surgery[12]. If you are getting chemotherapy[13], blood tests will be done routinely to check blood counts[14] and to see if the treatment is affecting other parts of your body.

Hyperlinks

1. www.cancer.org/treatment/understanding-your-diagnosis/tests/mri-for-cancer.html
2. www.cancer.org/cancer/brain-spinal-cord-tumors-adults/treating/surgery.html
3. www.cancer.org/cancer/brain-spinal-cord-tumors-adults/treating/surgery.html
4. www.cancer.org/cancer/brain-spinal-cord-tumors-adults/treating/radiation-therapy.html
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Brain and Spinal Cord Tumors in Adults: Prognostic Factors

For most types of cancer, the **stage** of the cancer – a measure of how far it has spread – is one of the most important factors in selecting treatment options and in determining a person's outlook (prognosis).

But tumors of the brain and spinal cord differ in some important ways from cancers in other parts of the body. One of the main reasons other cancers are dangerous is that they can spread throughout the body. Tumors starting in the brain or spinal cord can spread to other parts of the central nervous system, but they almost never spread to other organs. These tumors are dangerous because they can interfere with essential brain functions.

Because tumors in the brain or spinal cord almost never spread to other parts of the body, they do not have a formal staging system like most other cancers. Some of the

important factors that help determine a person's outlook include:

- The person's age
- Their functional level (whether the tumor is affecting normal brain functions and everyday activity)
- The type of tumor[1] (such as astrocytoma, ependymoma, etc.)
- The grade of the tumor[2] (how quickly the tumor is likely to grow, based on how the cells look under a microscope)
- If the tumor cells have certain gene mutations or other changes (For example, tumors with a mutation in the *IDH1* or *IDH2* gene, known as "IDH-mutant" tumors, tend to grow more slowly and have a better outlook than tumors without these mutations.)
- The location and size of the tumor
- How much of the tumor can be removed by surgery[3] (if it can be done)
- Whether or not the tumor has spread through the cerebrospinal fluid to other parts of the brain or spinal cord
- Whether or not tumor cells have spread beyond the central nervous system

If you have a brain or spinal cord tumor, talk to your doctor to learn more about how these and other factors might affect your outlook and treatment options.

Hyperlinks

1. www.cancer.org/cancer/brain-spinal-cord-tumors-adults/about/types-of-brain-tumors.html
2. www.cancer.org/cancer/brain-spinal-cord-tumors-adults/about/types-of-brain-tumors.html
3. www.cancer.org/cancer/brain-spinal-cord-tumors-adults/treating/surgery.html

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Survival Rates for Selected Adult Brain and Spinal Cord Tumors

Survival rates can give you an idea of what percentage of people with the same type of brain or spinal cord tumor are still alive a certain amount of time (such as 5 years) after they were diagnosed. They can't tell you how long you will live, but they may help give you a better understanding of how likely it is that your treatment will be successful.

Keep in mind that survival rates are estimates and are often based on previous outcomes of large numbers of people who had a specific type of tumor, but they can't predict what will happen in any particular person's case. These statistics can be confusing and may lead you to have more questions. Talk with your doctor about how these numbers may apply to you, as he or she is familiar with your situation.

What is a 5-year relative survival rate?

A **relative survival rate** compares people with the same type of tumor to people in the overall population. For example, if the **5-year relative survival rate** for a specific type of brain tumor is 70%, it means that people who have that tumor are, on average, about 70% as likely as people who don't have that tumor to live for at least 5 years after being diagnosed.

Survival rates for more common adult brain and spinal cord tumors

The numbers in the table come from the Central Brain Tumor Registry of the United States (CBTRUS) and are based on people who were treated between 2001 and 2015. As can be seen below, survival rates for some types of brain and spinal cord tumors can vary widely by age, with younger people tending to have better outlooks than older people. The survival rates for those 65 or older are generally lower than the rates for the ages listed below.

These numbers are for some of the more common types of brain and spinal cord tumors. Accurate numbers are not readily available for all types of tumors, often because they are rare or are hard to classify.

	5-Year Relative Survival Rate		
Type of Tumor	**Age**		
	20-44	**45-54**	**55-64**
Low-grade (diffuse) astrocytoma	73%	46%	26%
Anaplastic astrocytoma	58%	29%	15%
Glioblastoma	22%	9%	6%
Oligodendroglioma	90%	82%	69%
Anaplastic oligodendroglioma	76%	67%	45%
Ependymoma/anaplastic ependymoma	92%	90%	87%
Meningioma	84%	79%	74%

Understanding the numbers

- **These numbers don’t take everything into account.** Survival rates are grouped here based on tumor type and a person’s age. But other factors, such as the location of the tumor, whether it can be removed (or destroyed) completely, and if the tumor cells have certain gene or chromosome changes, can also affect your outlook.
- **People now being diagnosed with brain or spinal cord tumors may have a better outlook than these numbers show.** Treatments improve over time, and these numbers are based on people who were diagnosed and treated at least five

years earlier.
- Remember, **these survival rates can't predict what will happen to any individual person.** If you find these statistics are confusing and you have more questions, talk to your doctor to better understand your specific situation.

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Questions to Ask About Adult Brain and Spinal Cord Tumors

It's important for you to be able to have honest, open discussions with your cancer care team. Ask any question, no matter how small it might seem. Here are some you might want to ask, but be sure to add your own questions as you think of them.

When you're told you have a brain or spinal cord tumor

- What kind of tumor[1] do I have?
- Is the tumor benign or malignant? What does this mean?
- Where in the brain or spinal cord is the tumor? Has it grown into nearby areas?
- Will I need any other tests before we can decide on treatment?
- Will I need to see any other types of doctors?

When deciding on a treatment plan

- How much experience do you have treating this type of tumor?

- What are my treatment choices[2]? What do you recommend? Why?
- Should I get a second opinion[3]? Can you recommend a doctor or treatment center?
- How soon do we need to start treatment[4]?
- What's the goal of treatment (cure, prolonging life, relieving symptoms, etc.)?
- How likely is it that the tumor can be removed (or destroyed) completely?
- Will treatment relieve any of the symptoms I now have?
- What are the possible risks or side effects of treatment? What disabilities might I develop?
- What should I do to be ready for treatment?
- How long will treatment take? What will it be like? Where will it be given?
- What is my expected prognosis (outlook)?
- If I'm concerned about costs and insurance coverage for my diagnosis and treatment, who can help me?

During treatment

Once treatment begins, you'll need to know what to expect and what to look for. Not all of these questions might apply to you, but getting answers to the ones that do may be helpful.

- How will we know if the treatment is working (or has worked)?
- Is there anything I can do to help manage side effects[5]?
- What symptoms or side effects should I tell you about right away?
- How can I reach you or someone from your office on nights, holidays, or weekends?
- Are there any limits on what I can do?
- Can you suggest a mental health professional I can see if I start to feel overwhelmed, depressed, or distressed?

After treatment

- Are there any limits on what I can do?
- What symptoms should I watch for?
- What type of follow-up[6] will I need after treatment?
- How often will I need to have follow-up exams and tests?
- How will we know if the tumor has come back? What should I watch for?

- Where can I find more information and support?

Along with these sample questions, be sure to write down any others you want to ask. For instance, you might want information about recovery times so that you can plan your work or activity schedule. Or you might want to ask about clinical trials[7] that might be right for you.

Keep in mind that doctors aren't the only ones who can give you information. Other health care professionals, such as nurses and social workers, can answer some of your questions. To learn more about speaking with your health care team, see Talking With Your Doctor[8].

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1. www.cancer.org/cancer/brain-spinal-cord-tumors-adults/about/types-of-brain-tumors.html
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Our team is made up of doctors and oncology certified nurses with deep knowledge of cancer care as well as journalists, editors, and translators with extensive experience in medical writing.

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