Early Detection, Diagnosis, and Staging

Detection and Diagnosis

Catching cancer early often allows for more treatment options. Some early cancers may have signs and symptoms that can be noticed, but that 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
- How Are Brain and Spinal Cord Tumors in Adults Diagnosed?

Stages and Outlook (Prognosis)

After a cancer diagnosis, staging provides important information about the extent of cancer in the body and anticipated response to treatment.

- How Are Brain and Spinal Cord Tumors in Adults Staged?
- 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 cancer care team to help you better understand your cancer diagnosis and treatment options.

- What Should You Ask Your Doctor 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 cancer in people without any symptoms.) Most brain
tumors are found when a person sees a doctor because of signs or symptoms they are having (see  Signs and symptoms of adult brain and spinal cord tumors).

Most often, the outlook for people with brain and spinal cord tumors 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.

For people with certain inherited syndromes that put them at higher risk for brain tumors, such as neurofibromatosis or tuberous sclerosis, 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.

• References
See all references for Brain and Spinal Cord Tumors in Adults

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Signs and Symptoms of Adult Brain and Spinal Cord Tumors

Signs and symptoms of brain or spinal cord tumors may occur 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 may cause the pressure inside the skull (known as intracranial pressure) to rise. 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 central nervous system**

Brain and spinal cord tumors often cause problems with the specific functions of the region they develop in. But these symptoms can be caused by any disease 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.
- Tumors in an area of the brain called the basal ganglia typically cause abnormal movements and an abnormal positioning of the body.
- If the tumor is in the cerebellum, which controls coordination, a person might have trouble with walking or other everyday functions, even eating.
- 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 loss of hearing, balance problems, weakness of some facial muscles, 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...
The brain also controls functions of some other organs, including hormone production, so brain tumors can also cause many other symptoms that aren’t listed here.

Having one or more of the symptoms above does not mean that you definitely 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 that the cause can be found and treated, if needed.

References
See all references for Brain and Spinal Cord Tumors in Adults

How Are Brain and Spinal Cord Tumors in Adults Diagnosed?

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 get a complete medical history, focusing on your symptoms and when they began. The doctor will also do a neurologic exam to check your brain and spinal cord function. It tests reflexes, muscle strength, vision, eye and mouth movement, coordination, balance, alertness, and other functions.

If the results of the exam are abnormal, your doctor may refer you 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 or 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. The pictures may be looked at by doctors specializing in this field (neurosurgeons, neurologists, and neuroradiologists) as well as by your primary doctor.

Magnetic resonance imaging (MRI) and computed tomography (CT) scans are used most often for brain diseases. These scans will show a brain tumor, if one is present, in almost all cases. 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 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 image 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. The energy from the radio waves is absorbed and then released in a pattern formed by the type of body tissue and by certain diseases. A computer translates the pattern into a very detailed image of parts of the body. A contrast material called gadolinium may be injected into a vein before the scan to help see details better.

MRI scans can take a long time — often up to an hour. You may have to lie on a table that slides inside a narrow tube, which can be confining and might upset people with a fear of enclosed spaces. Newer, open MRI machines can sometimes be used instead, but they might result in less detailed images and can’t be used in all cases. The machine also makes buzzing and clicking noises that you may find disturbing. Some people might need medicine to help them relax for the test.

Magnetic resonance angiography (MRA): This special form of MRI may be done to look at the blood vessels in the brain. This can be very useful before surgery to help the surgeon plan an operation.

Magnetic resonance spectroscopy (MRS): This test is like an MRI, except that it measures radio wave interactions with different chemicals in the brain. MRS highlights some features of brain tumors that are not clearly seen by MRI. It creates graph-like results called spectra (although basic images can also be created). This might give
clues as to the type of tumor, but in most cases a biopsy of the tumor is 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 newer type of MRI 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 determine which parts of the brain to avoid when planning surgery or radiation therapy.

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**

The CT scan is an x-ray test that produces detailed cross-sectional images of your brain and spinal cord (or other parts of the body). Instead of taking one picture, like a regular x-ray, a CT scanner takes many pictures as it rotates around you while you lie on a table. A computer then combines these pictures into images of slices 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.

Before the scan, you may get an injection of a contrast dye through an IV (intravenous) line. This helps better outline any tumors that are present. The contrast may cause some flushing (a feeling of warmth, especially in the face). Some people are allergic and get hives. Rarely, people have more serious reactions like trouble breathing or low
blood pressure. Be sure to tell the doctor if you have any allergies or if you ever had a reaction to any contrast material used for x-rays.

A CT scanner has been described as a large donut, with a narrow table that slides in and out of the middle opening. You need to lie still on the table while the scan is being done. Some people feel a bit confined by the ring while the pictures are being taken, although it is not as narrow as an MRI tube.

**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 this test, a radioactive substance (usually a type of sugar known as *FDG*) is injected into the blood. The amount of radioactivity used is very low and passes out of the body within a day or so. Because tumor cells in the body grow quickly, they absorb larger amounts of the sugar than most other cells. After about an hour, you are moved onto a table in the PET scanner. You lie on the table for about 30 minutes while a special camera creates 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 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. Any remaining tumor will show up on the PET scan, while scar tissue will not.

**Chest x-ray**

A chest x-ray may be done to look for tumors in the lungs if a tumor is found in the brain, because in adults most tumors in the brain have actually 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.

**Angiogram**

For this test, a special dye is injected into blood vessels near the tumor, and the area is then viewed with x-rays. This helps doctors look at the blood supply of a tumor.
This test is not done much for brain or spinal cord tumors anymore, as it has largely been replaced by other tests that can look at blood vessels, such as computerized tomographic angiography (CTA) or magnetic resonance angiography (MRA).

Rarely, an angiogram may be used as part of the treatment for certain brain tumors. It is done as a first step of a procedure called *embolization*, in which the radiologist injects tiny particles into the blood vessels feeding the tumor to block them and make it easier to remove the tumor.

**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 most often these scans can’t tell exactly what type of tumor it is. 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** to treat the tumor.

Once the tissue is removed, it is looked at under a microscope by 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 determines if the tumor is benign or malignant (cancerous) and exactly what type of tumor it is.

Sometimes, a tumor may look so much like an astrocytoma on an MRI scan 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.

There are 2 main types of biopsies for brain tumors.

**Stereotactic (needle) biopsy**

This type of biopsy may be used if, based on imaging tests, the risks of surgery to remove the tumor might be too high (such as with some tumors in vital areas, those deep within the brain, or other tumors that probably can’t be treated 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.)
A rigid frame may then be attached to the head. This helps make sure the surgeon is targeting the tumor precisely. An incision (cut) is made in the scalp and a small hole is drilled in the skull. An MRI or CT scan is often used along with the frame to help the neurosurgeon guide a hollow needle into the tumor to remove small pieces of tissue.

Another approach is to get an MRI or CT, use scalp markers or facial and scalp contours to create a map of the inside of the head, and then use an image-guidance system to direct the needle into the tumor. This still requires making an incision and drilling a small hole into the skull.

The removed tissue is sent to a pathologist, who looks at it under a microscope to determine what type of tumor it is. This is very important in determining the prognosis (outlook) and the best course of treatment.

**Surgical or open biopsy (craniotomy)**

If imaging tests show the tumor can 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 the Surgery for adult brain and spinal cord tumors section) to remove all or most of the tumor. (Removing most of the tumor is known as debulking.)

Small samples of the tumor are looked at right away by the pathologist while the patient is still in the operating room, for a preliminary diagnosis. 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 that are done on biopsy or tissue samples in *Testing Biopsy and Cytology Specimens for Cancer*.

**Lumbar puncture (spinal tap)**

This test is used to look for cancer cells in the cerebrospinal fluid (CSF), the liquid that surrounds the brain and spinal cord. For this test, you lay 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 under a microscope 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 pressure in the fluid, 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 often the lymphoma cells 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. If you are getting chemotherapy, blood tests will be done routinely to check blood counts and to see if the treatment is affecting other parts of the body.

- References

See all references for Brain and Spinal Cord Tumors in Adults

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How Are Brain and Spinal Cord Tumors in Adults Staged?

The stage of a cancer is a measure of how far it has spread. A staging system is a standard way for the cancer care team to describe the extent of this spread. For most types of cancer, the stage is one of the most important factors in selecting treatment options and in determining the 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 functions of the brain.

Because tumors in the brain or spinal cord almost never spread to other parts of the body, there is no formal staging system for them. Some of the important factors that help determine a person’s outlook include:

- The person’s age
- The person’s functional level (whether the tumor is affecting normal brain functions and everyday activity)
- The type of tumor (such as astrocytoma, ependymoma, etc.)
- The grade of the tumor (how quickly the tumor is likely to grow, based on how the cells look under a microscope)
- The size and location of the tumor
- How much of the tumor can be removed by surgery (if it can be done)
- Whether or not the tumor has spread through the cerebrospinal fluid (CSF) to other parts of the brain or spinal cord
- Whether or not tumor cells have spread beyond the central nervous system

References

See all references for Brain and Spinal Cord Tumors in Adults

Survival Rates for Selected Adult Brain and Spinal Cord Tumors

Survival rates are a way for doctors and patients to get a general idea of the outlook (prognosis) for people with a certain type of tumor. Some people want to know the statistics for people in their situation, while others may not find them helpful, or may even not want to know them. If you do not want to know the survival rates for adult brain
and spinal cord tumors, stop reading here and skip to the next section.

The 5-year survival rate refers to the percentage of people who live at least 5 years after being diagnosed. Of course, many of these people live much longer than 5 years. Five-year relative survival rates, such as the numbers below, assume that some people will die of other causes and compare the observed survival with that expected for people without the tumor. This is a more accurate way to describe the prognosis for patients with a particular type of tumor.

To get 5-year survival rates, doctors have to look at people who were treated at least 5 years ago. Although the numbers below are among the most current available, improvements in treatment since then may result in a better outlook for people now being diagnosed with brain and spinal cord tumors.

The numbers below come from the Central Brain Tumor Registry of the United States (CBTRUS) and are based on people who were treated between 1995 and 2010. As can be seen below, survival rates for brain and spinal cord tumors can vary widely by age, with younger people tending to have having 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. Numbers are not readily available for all types of tumors, often because they are rare or are hard to classify.

<table>
<thead>
<tr>
<th>Type of Tumor</th>
<th>20-44</th>
<th>45-54</th>
<th>55-64</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low-grade (diffuse) astrocytoma</td>
<td>65%</td>
<td>43%</td>
<td>21%</td>
</tr>
<tr>
<td>Anaplastic astrocytoma</td>
<td>49%</td>
<td>29%</td>
<td>10%</td>
</tr>
<tr>
<td>Glioblastoma</td>
<td>17%</td>
<td>6%</td>
<td>4%</td>
</tr>
<tr>
<td>Oligodendroglioma</td>
<td>85%</td>
<td>79%</td>
<td>64%</td>
</tr>
<tr>
<td>Anaplastic oligodendroglioma</td>
<td>67%</td>
<td>55%</td>
<td>38%</td>
</tr>
<tr>
<td>Ependymoma/anaplastic ependymoma</td>
<td>91%</td>
<td>86%</td>
<td>85%</td>
</tr>
<tr>
<td>Meningioma</td>
<td>92%</td>
<td>77%</td>
<td>67%</td>
</tr>
</tbody>
</table>

Survival rates are based on previous outcomes of large numbers of people who had the disease, but they can't predict what will happen in any person's case. The type of tumor is important in estimating a person's outlook. But many other factors can also affect outlook, such as the location of the tumor and whether it can be removed with surgery, as well as a person's age and overall health. Even when taking these other factors into account, survival rates are at best rough estimates. Your doctor is your best source of
What Should You Ask Your Doctor About Adult Brain and Spinal Cord Tumors?

It’s important for you 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. Be sure to add your own questions as you think of them. Nurses, social workers, and other members of the treatment team can also answer many of your questions.

- What kind of tumor do I have?
- Is the tumor benign or malignant? What does this mean?
- Where in the brain or spinal cord is the tumor and how far has it spread?
- Do I need other tests before we can decide on treatment?
- How much experience do you have treating this type of tumor?
- Should I get a second opinion? Can you recommend a doctor or cancer center?
- What are my treatment choices? What do you recommend? Why?
- What’s the goal of treatment (cure, prolonging life, relieving symptoms, etc.)?
- 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)?
- What would we do if the treatment doesn’t work or if the tumor comes back?
What type of follow-up will I need after treatment?
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 that might be right for you.

References
See all references for Brain and Spinal Cord Tumors in Adults

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