
Brain and Spinal Cord Tumor in Adults Causes, Risk Factors, and Prevention

Learn about the risk factors for brain and spinal cord tumors and if there are things that you might be able to do to help lower your risk.

Risk Factors

A risk factor is anything that increases your chances of getting a disease such as cancer. Learn more about the risk factors for brain and spinal cord tumors.

- [Risk Factors for Brain and Spinal Cord Tumors](#)
- [What Causes Brain and Spinal Cord Tumors in Adults?](#)

Prevention

Other than radiation exposure, there are no known lifestyle-related or environmental causes of brain and spinal cord tumors, so at this time there is no known way to protect against most of these tumors.

Risk Factors for Brain and Spinal Cord Tumors

- [Radiation exposure](#)

- [Family history](#)
- [Having a weakened immune system](#)
- [Factors with uncertain, controversial, or unproven effects on brain tumor risk](#)

A risk factor is anything that increases your chances of getting a disease such as a brain or spinal cord tumor. Different types of cancer have different risk factors. Some risk factors, like smoking, you can change. Others, like your age or family history, can't be changed.

But having a risk factor, or even several, does not always mean that a person will get the disease, and many people get brain or spinal cord tumors without having any known risk factors.

Many different types of tumors can start in the brain or spinal cord, and while they might have some things in common, these different tumors might not all have the same risk factors.

Most brain tumors are not linked with any known risk factors and have no obvious cause. But there are a few factors that can raise the risk of brain tumors.

Radiation exposure

The best known environmental risk factor for brain tumors is [radiation exposure](#)¹, most often from radiation therapy to treat some other condition. For example, before the risks of radiation were known, children with ringworm of the scalp (a fungal infection) were sometimes treated with low-dose radiation therapy, which was later found to increase their risk of some types of brain tumors as they got older.

Today, most radiation-induced brain tumors are caused by radiation to the head given to treat other cancers. They occur most often in people who received radiation to the brain as children as part of their treatment for [leukemia](#)². These brain tumors most often develop around 10 to 15 years after the radiation, but sometimes they might not appear until decades later.

Radiation-induced tumors are still fairly rare, but because of the increased risk (as well as the other side effects), radiation therapy is only given to the head after carefully weighing the possible benefits and risks. For most patients with other cancers in the brain or head, the benefits of radiation therapy far outweigh the risk of developing a brain tumor years later.

The possible risk from exposure to [imaging tests](#)³ that use radiation, such as x-rays or CT scans, is not known for sure. These tests use much lower levels of radiation than those used in radiation treatments, so if there is any increase in risk, it is likely to be very small. But to be safe, most doctors recommend that people (especially children and pregnant women) not get these tests unless they are clearly needed.

Family history

Most people with brain tumors do not have a family history of them, but in rare cases brain and spinal cord tumors do run in families. In general, patients with familial cancer syndromes tend to have many tumors that first occur when they are young. Some of these families have well-defined disorders, such as:

Neurofibromatosis type 1 (NF1)

This genetic disorder, also known as **von Recklinghausen disease**, is the most common syndrome linked to brain or spinal cord tumors. People with this condition have higher risks of schwannomas, meningiomas, and certain types of gliomas, as well as neurofibromas (benign tumors of peripheral nerves). Changes in the *NF1* gene cause this disorder. These changes are inherited from a parent in about half of all cases. In the other half, the *NF1* gene changes occur before birth in people whose parents did not have this condition.

Neurofibromatosis type 2 (NF2)

This condition, which is much less common than NF1, is associated with vestibular schwannomas (acoustic neuromas), which almost always occur on both sides of the head. It is also linked with an increased risk of meningiomas or spinal cord ependymomas. Changes in the *NF2* gene are usually responsible for neurofibromatosis type 2. Like *NF1*, the gene changes are inherited in about half of cases. In the other half, they occur before birth in children without a family history.

Tuberous sclerosis

People with this condition may have subependymal giant cell astrocytomas (SEGAs), which are low-grade astrocytomas that develop beneath the ependymal cells of the ventricles. They may also have other benign tumors of the brain, skin, heart, kidneys, and other organs. This condition is caused by changes in either the *TSC1* or the *TSC2* gene. These gene changes can be inherited from a parent, but most often they develop in people without a family history.

Von Hippel-Lindau syndrome

People with this condition tend to develop benign or cancerous tumors in different parts of the body, including hemangioblastomas (benign blood vessel tumors) in the brain, spinal cord, or retina, as well as tumors of the inner ear, kidney, adrenal gland, and pancreas. It is caused by changes in the *VHL* gene. Most often the gene changes are inherited, but in some cases the changes happen before birth in people whose parents don't have them.

Li-Fraumeni syndrome

People with this condition are at higher risk for developing gliomas, along with [breast cancer](#)⁴, [soft tissue sarcomas](#)⁵, [leukemia](#)⁶, [adrenal gland cancer](#)⁷, and certain other types of cancer. It is caused by changes in the *TP53* gene.

Turcot syndrome

Turcot syndrome (also known as **brain tumor-polyposis syndrome**) describes people who have many colon polyps and an increased risk of [colorectal cancer](#)⁸, as well as an increased risk for certain types of brain tumors. But this syndrome is actually made up of two different hereditary conditions:

- When linked with **familial adenomatous polyposis (FAP)**, there is a mutation in the *APC* gene. In people with this gene mutation, brain tumors are typically medulloblastomas.
- When linked with **Lynch syndrome** (also known as **hereditary non-polyposis colorectal cancer** or HNPCC), the mutation is in one of the mismatch repair genes, such as *MLH1* or *PMS2*. In people with one of these gene mutations, brain tumors are usually gliomas.

Other syndromes

Other inherited conditions are also linked with increased risks of certain types of brain and spinal cord tumors, including:

- Gorlin syndrome (basal cell nevus syndrome)
- Cowden syndrome

Some families may have genetic disorders that are not well recognized or that may

even be unique to a particular family.

Having a weakened immune system

People with weakened immune systems have an increased risk of developing [lymphomas](#)⁹ of the brain or spinal cord (known as **primary CNS lymphomas**). Lymphomas are cancers of lymphocytes, a type of white blood cell that fights disease. Primary CNS lymphoma is less common than lymphoma that develops outside the brain.

A weakened immune system can be congenital (present at birth), or it can be caused by treatments for other cancers, treatment to prevent rejection of transplanted organs, or diseases such as [acquired immunodeficiency syndrome \(AIDS\)](#)¹⁰.

Factors with uncertain, controversial, or unproven effects on brain tumor risk

Cell phone use

Cell phones give off [radiofrequency \(RF\) rays](#)¹¹, a form of energy on the electromagnetic spectrum between FM radio waves and those used in microwave ovens, radar, and satellite stations. Cell phones do not give off [ionizing radiation](#)¹², the type that can cause cancer by damaging the DNA inside cells. Still, there have been concerns that the phones, whose antennae are built-in and therefore are placed close to the head when being used, might somehow raise the risk of brain tumors.

Some studies have suggested a possible increased risk of brain tumors or of vestibular schwannomas (acoustic neuromas) with cell phone use, but most of the larger studies done so far have not found an increased risk, either overall or among specific types of tumors. Still, there are very few studies of long-term use (10 years or more), and cell phones haven't been around long enough to determine the possible risks of lifetime use. The same is true of any possible higher risks in children, who are increasingly using cell phones. Cell phone technology also continues to change, and it's not clear how this might affect any risk.

These risks are being studied, but it will probably be many years before firm conclusions can be made. In the meantime, for people concerned about the possible risks, there are ways to lower your exposure, such as using the phone's speaker or an earpiece to move the phone itself away from the head.

For more on this topic, see [Cellular Phones](#)¹³.

Other factors

Other environmental factors such as exposure to vinyl chloride (a chemical used to manufacture plastics), petroleum products, and certain other chemicals have been linked with an increased risk of brain tumors in some studies but not in others.

Exposure to [aspartame](#)¹⁴ (a sugar substitute), exposure to electromagnetic fields from [power lines](#)¹⁵ and transformers, and infection with [certain viruses](#)¹⁶ have been suggested as possible risk factors, but most researchers agree that there is no convincing evidence to link these factors to brain tumors. Research on these and other possible risk factors continues.

Hyperlinks

1. www.cancer.org/cancer/risk-prevention/radiation-exposure/x-rays-gamma-rays.html
2. www.cancer.org/cancer/types/leukemia.html
3. www.cancer.org/cancer/diagnosis-staging/tests/imaging-tests/imaging-radiology-tests-for-cancer.html
4. www.cancer.org/cancer/types/breast-cancer.html
5. www.cancer.org/cancer/types/soft-tissue-sarcoma.html
6. www.cancer.org/cancer/types/leukemia.html
7. www.cancer.org/cancer/types/adrenal-cancer.html
8. www.cancer.org/cancer/types/colon-rectal-cancer.html
9. www.cancer.org/cancer/types/non-hodgkin-lymphoma.html
10. www.cancer.org/cancer/risk-prevention/infections/hiv-infection-aids.html
11. www.cancer.org/cancer/risk-prevention/radiation-exposure/radiofrequency-radiation.html
12. www.cancer.org/cancer/risk-prevention/radiation-exposure/x-rays-gamma-rays.html
13. www.cancer.org/cancer/risk-prevention/radiation-exposure/cellular-phones.html
14. www.cancer.org/cancer/risk-prevention/chemicals/aspartame.html
15. www.cancer.org/cancer/risk-prevention/radiation-exposure/extremely-low-frequency-radiation.html

16. www.cancer.org/cancer/risk-prevention/infections.html

References

Dorsey JF, Salinas RD, Dang M, et al. Chapter 63: Cancer of the central nervous system. In: Niederhuber JE, Armitage JO, Doroshow JH, Kastan MB, Tepper JE, eds. *Abeloff's Clinical Oncology*. 6th ed. Philadelphia, Pa: Elsevier; 2020.

Michaud D, Batchelor T. Risk factors for brain tumors. UpToDate. 2020. Accessed at <https://www.uptodate.com/contents/risk-factors-for-brain-tumors> on February 7, 2020.

National Cancer Institute Physician Data Query (PDQ). Adult Central Nervous System Tumors Treatment. 2020. Accessed at www.cancer.gov/types/brain/hp/adult-brain-treatment-pdq on February 7, 2020.

US National Library of Medicine. Genetics Home Reference: Your Guide to Understanding Genetic Conditions. Accessed at <https://ghr.nlm.nih.gov/> on February 10, 2020.

Last Revised: May 5, 2020

What Causes Brain and Spinal Cord Tumors in Adults?

- [Inherited gene changes](#)
- [Gene changes acquired during a person's lifetime](#)

Many different types of tumors can start in the brain or spinal cord. These different tumors are unlikely to all have the same causes, but they might share some things in common.

The cause of most brain and spinal cord tumors is not fully understood, and there are

very few well-established [risk factors](#). But researchers have found some of the changes that occur in normal brain cells that may lead them to form brain tumors.

Normal human cells grow and function based mainly on the information in each cell's DNA. Brain and spinal cord tumors, like other tumors, are caused by changes in the DNA inside cells. DNA is the chemical that makes up our **genes**, which control how our cells function. We usually look like our parents because they are the source of our DNA. But DNA affects more than how we look.

Some genes control when our cells grow, divide into new cells, and die:

- Certain genes that help cells grow, divide, and stay alive are called **oncogenes**.
- Genes that help keep cell division under control, repair mistakes in DNA, or make cells die at the right time are called **tumor suppressor genes**.

Cancers can be caused by DNA changes that turn on oncogenes or turn off tumor suppressor genes. These gene changes can be inherited from a parent, but more often they happen during a person's lifetime.

Inherited gene changes

Researchers have found gene changes that cause some rare [inherited syndromes](#)¹ (like neurofibromatosis, tuberous sclerosis, Li-Fraumeni syndrome, and von Hippel-Lindau syndrome) that increase the risk of developing some brain and spinal cord tumors. For example, the Li-Fraumeni syndrome is caused by changes in the *TP53* tumor suppressor gene. Normally, this gene prevents cells with damaged DNA from growing. Changes in this gene increase the risk of developing brain tumors (particularly gliomas), as well as some other cancers.

Gene changes acquired during a person's lifetime

It's usually not known why people **without** inherited syndromes develop brain or spinal cord tumors. Most exposures that cause cancer, such as chemicals in tobacco smoke, somehow damage DNA. But the brain is relatively protected from most cancer-causing chemicals that we might breathe in or eat, so these factors are not likely to play a major role in these cancers.

Several different gene changes usually occur in normal cells before they become cancerous. There are many kinds of brain tumors, each of which may have different sets of gene changes. A number of gene changes have been found in different brain

tumor types, but there are probably many others that have not yet been found.

Researchers now understand some of the gene changes that occur in different types of brain tumors, but it's still not clear what causes most of these changes. Some gene changes might be inherited, but most brain and spinal cord tumors are not the result of known inherited syndromes. Other than [radiation](#)², no known lifestyle-related or environmental factors are clearly linked to brain tumors. Most gene changes are probably just random events that sometimes happen inside a cell, without having an outside cause.

Hyperlinks

1. www.cancer.org/cancer/risk-prevention/genetics/family-cancer-syndromes.html
2. www.cancer.org/cancer/risk-prevention/radiation-exposure.html

References

Dorsey JF, Salinas RD, Dang M, et al. Chapter 63: Cancer of the central nervous system. In: Niederhuber JE, Armitage JO, Doroshow JH, Kastan MB, Tepper JE, eds. *Abeloff's Clinical Oncology*. 6th ed. Philadelphia, Pa: Elsevier; 2020.

Michaud D, Batchelor T. Risk factors for brain tumors. UpToDate. 2020. Accessed at <https://www.uptodate.com/contents/risk-factors-for-brain-tumors> on February 7, 2020.

National Cancer Institute Physician Data Query (PDQ). Adult Central Nervous System Tumors Treatment. 2020. Accessed at www.cancer.gov/types/brain/hp/adult-brain-treatment-pdq on February 7, 2020.

Last Revised: May 5, 2020

Can Brain and Spinal Cord Tumors in Adults Be Prevented?

- [Limiting radiation exposure to the head](#)

The risk of many cancers in adults can be reduced with certain lifestyle changes (such as quitting smoking). But other than [radiation exposure](#)¹, there are no known lifestyle-related or environmental [risk factors](#) for brain and spinal cord tumors, so at this time there is no known way to protect against most of these tumors.

Limiting radiation exposure to the head

For most people with other types of cancer in or near the head, [radiation therapy](#)² may be given if doctors feel the benefits of the treatment outweigh the small risk of developing a brain tumor years later. Still, when it is needed, doctors try to limit the dose of radiation as much as possible.

[Imaging tests](#)³ such as x-rays or CT scans use much lower levels of radiation than those used for cancer treatment. If there is any increase in risk from these tests, it is likely to be very small, but to be safe, most doctors recommend that people (especially pregnant women and children) not get these tests unless they are absolutely needed.

Hyperlinks

1. www.cancer.org/cancer/risk-prevention/radiation-exposure.html
2. www.cancer.org/cancer/managing-cancer/treatment-types/radiation.html
3. www.cancer.org/cancer/diagnosis-staging/tests/imaging-tests/imaging-radiology-tests-for-cancer.html

References

Dorsey JF, Salinas RD, Dang M, et al. Chapter 63: Cancer of the central nervous system. In: Niederhuber JE, Armitage JO, Doroshow JH, Kastan MB, Tepper JE, eds. *Abeloff's Clinical Oncology*. 6th ed. Philadelphia, Pa: Elsevier; 2020.

Michaud D, Batchelor T. Risk factors for brain tumors. UpToDate. 2020. Accessed at <https://www.uptodate.com/contents/risk-factors-for-brain-tumors> on February 7, 2020.

Last Revised: May 5, 2020

Written by

The American Cancer Society medical and editorial content team
(<https://www.cancer.org/cancer/acs-medical-content-and-news-staff.html>)

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.

American Cancer Society medical information is copyrighted material. For reprint requests, please see our Content Usage Policy (www.cancer.org/about-us/policies/content-usage.html).

cancer.org | 1.800.227.2345