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## Childhood Brain and Spinal Cord Tumors Treatment Overview (PDQ®)

### Patient Version

#### Authors

PDQ Pediatric Treatment Editorial Board.

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### General Information About Childhood Brain and Spinal Cord Tumors

#### Key Points for This Section

- A childhood brain or spinal cord tumor is a disease in which abnormal cells form in the tissues of the brain or spinal cord.
- The brain controls many important body functions.
- The spinal cord connects the brain with nerves in most parts of the body.
- Brain and spinal cord tumors are a common type of childhood cancer.
- The cause of most childhood brain and spinal cord tumors is unknown.
- The signs and symptoms of childhood brain and spinal cord tumors are not the same in every child.
- Tests that examine the brain and spinal cord are used to detect (find) childhood brain and spinal cord tumors.
- Most childhood brain tumors are diagnosed and removed in surgery.
- Some childhood brain and spinal cord tumors are diagnosed by imaging tests.
- Certain factors affect prognosis (chance of recovery).

#### **A childhood brain or spinal cord tumor is a disease in which abnormal cells form in the tissues of the brain or spinal cord.**

There are many types of childhood brain and spinal cord tumors. The tumors are formed by the abnormal growth of cells and may grow in different areas of the brain or spinal cord.

The tumors may be benign (not cancer) or malignant (cancer). Benign brain tumors may grow and press on nearby areas of the brain. They rarely spread into other brain tissue. Malignant brain tumors may be low grade or high grade. High-grade tumors are likely to grow quickly and spread into other brain tissue. Low-grade tumors tend to grow and spread more slowly than high-grade tumors. When a tumor grows into or presses on an area of the brain, it may stop that part of the brain from working the way it should. Both benign and malignant brain tumors can cause signs or

symptoms, need treatment, and can recur (come back).

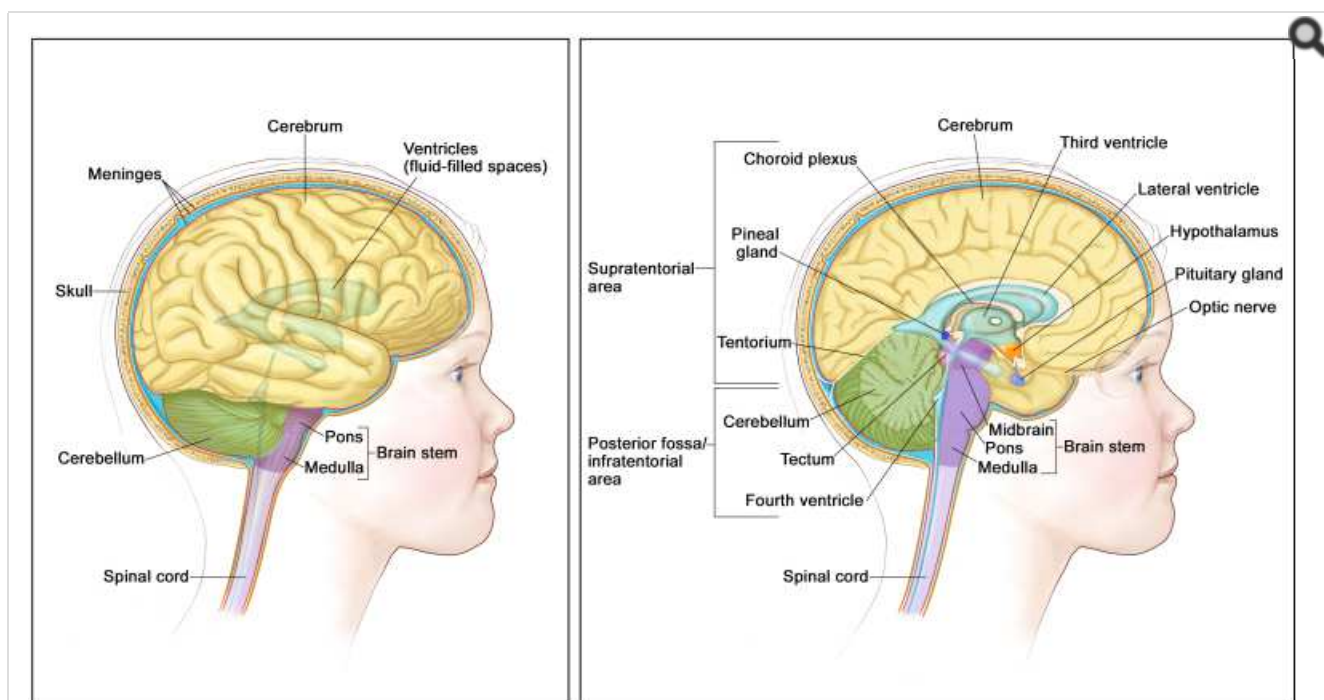
Together, the brain and spinal cord make up the central nervous system (CNS).

This summary is about primary benign and malignant brain and spinal cord tumors.

### The brain controls many important body functions.

The brain has three major parts:

- The cerebrum is the largest part of the brain. It is at the top of the head. The cerebrum controls thinking, learning, problem-solving, emotions, speech, reading, writing, and voluntary movement.
- The cerebellum is in the lower back of the brain (near the middle of the back of the head). It controls voluntary movement, balance, and posture.
- The brain stem connects the brain to the spinal cord. It is in the lowest part of the brain (just above the back of the neck). The brain stem controls breathing, heart rate, and the nerves and muscles used in seeing, hearing, walking, talking, and eating.



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Anatomy of the brain. The supratentorial area (the upper part of the brain) contains the cerebrum, lateral ventricle and third ventricle (with cerebrospinal fluid shown in blue), choroid plexus, pineal gland, hypothalamus, pituitary gland, and optic nerve. The posterior fossa/infratentorial area (the lower back part of the brain) contains the cerebellum, tectum, fourth ventricle, and brain stem (midbrain, pons, and medulla). The tentorium separates the supratentorium from the infratentorium (right panel). The skull and meninges protect the brain and spinal cord (left panel).

### The spinal cord connects the brain with nerves in most parts of the body.

The spinal cord is a column of nerve tissue that runs from the brain stem down the center of the back. It is covered by three thin layers of tissue called membranes. The spinal cord and membranes are surrounded by the vertebrae (back bones). Spinal cord nerves carry messages between the brain and the rest of the body, such as a message from the brain to cause muscles to move or a message from the skin to the brain to feel touch.

### Brain and spinal cord tumors are a common type of childhood cancer.

Although cancer is rare in children, brain and spinal cord tumors are the second most common type of childhood

cancer, after leukemia. Brain tumors can occur in both children and adults. Treatment for children is usually different than treatment for adults. (See the PDQ summary on [Adult Central Nervous System Tumors Treatment](#) for more information about the treatment of adults.)

Metastatic tumors are formed by cancer cells that begin in other parts of the body and spread to the brain or spinal cord. Treatment of metastatic brain and spinal cord tumors is not covered in this summary.

**The cause of most childhood brain and spinal cord tumors is unknown.**

**The signs and symptoms of childhood brain and spinal cord tumors are not the same in every child.**

Signs and symptoms depend on the following:

- Where the tumor forms in the brain or spinal cord.
- The size of the tumor.
- How fast the tumor grows.
- The child's age and development.

Signs and symptoms may be caused by childhood brain and spinal cord tumors or by other conditions. Check with your child's doctor if your child has any of the following:

### **Brain Tumor Signs and Symptoms**

- Morning headache or headache that goes away after vomiting.
- Frequent nausea and vomiting.
- Vision, hearing, and speech problems.
- Loss of balance and trouble walking.
- Unusual sleepiness or change in activity level.
- Unusual changes in personality or behavior.
- Seizures.
- Increase in the head size (in infants).

### **Spinal Cord Tumor Signs and Symptoms**

- Back pain or pain that spreads from the back towards the arms or legs.
- A change in bowel habits or trouble urinating.
- Weakness in the legs.
- Trouble walking.

In addition to these signs and symptoms of brain and spinal cord tumors, some children are unable to reach certain growth and development milestones such as sitting up, walking, and talking in sentences.

**Tests that examine the brain and spinal cord are used to detect (find) childhood brain and spinal cord tumors.**

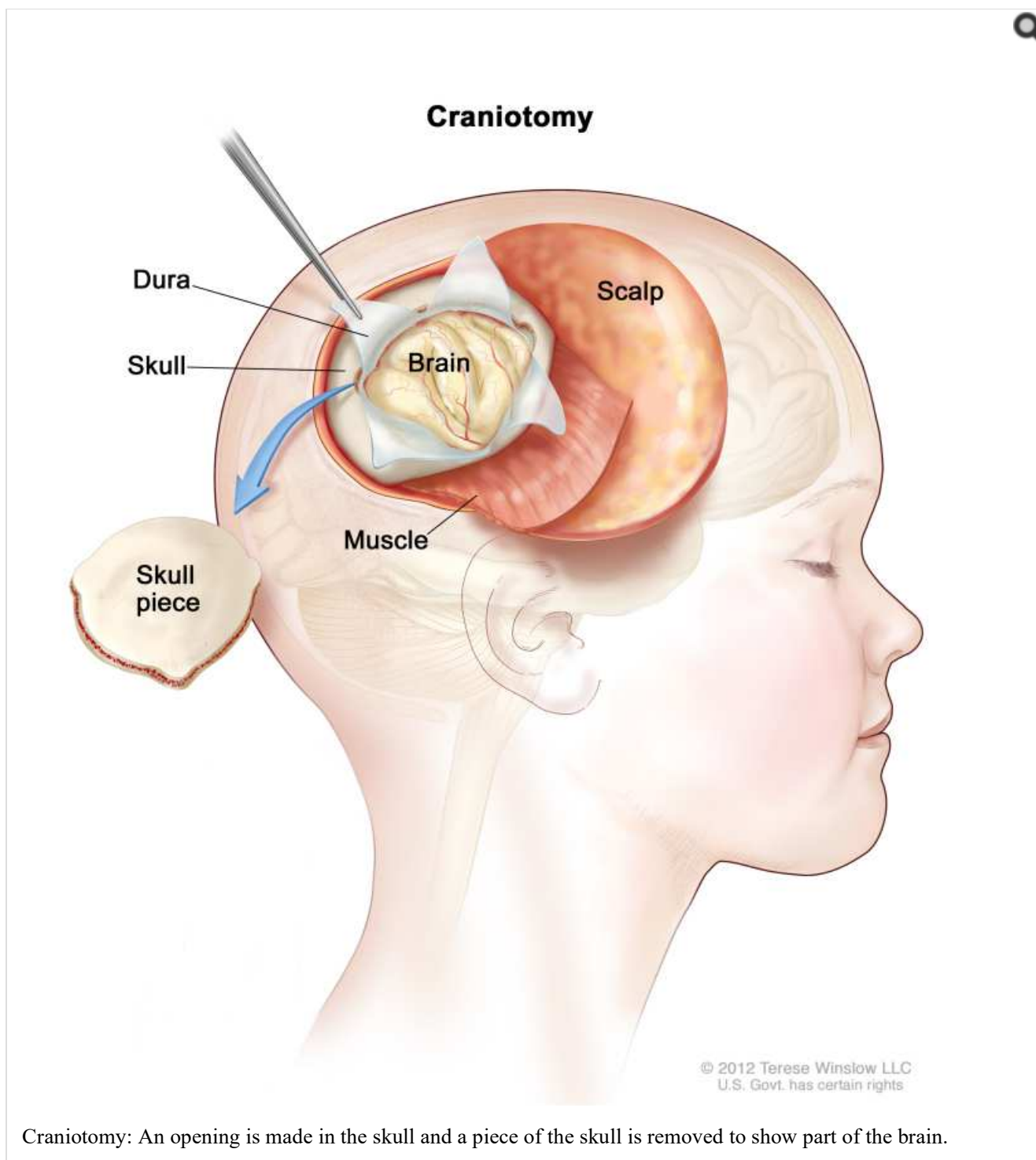
The following tests and procedures may be used:

- **Physical exam and health history:** An exam of the body to check general signs of health, including checking for signs of disease, such as lumps or anything else that seems unusual. A history of the patient's health habits and past illnesses and treatments will also be taken.

- **Neurological exam:** A series of questions and tests to check the brain, spinal cord, and nerve function. The exam checks a person's mental status, coordination, and ability to walk normally, and how well the muscles, senses, and reflexes work. This may also be called a neuro exam or a neurologic exam.
- **MRI (magnetic resonance imaging) with gadolinium:** A procedure that uses a magnet, radio waves, and a computer to make a series of detailed pictures of the brain and spinal cord. A substance called gadolinium is injected into a vein. The gadolinium collects around the cancer cells so they show up brighter in the picture. This procedure is also called nuclear magnetic resonance imaging (NMRI).
- **Serum tumor marker test:** A procedure in which a sample of blood is examined to measure the amounts of certain substances released into the blood by organs, tissues, or tumor cells in the body. Certain substances are linked to specific types of cancer when found in increased levels in the blood. These are called tumor markers.

### **Most childhood brain tumors are diagnosed and removed in surgery.**

If doctors think there might be a brain tumor, a biopsy may be done to remove a sample of tissue. For tumors in the brain, a part of the skull is removed and a needle is used to remove a sample of tissue. Sometimes, the needle is guided by a computer. A pathologist views the tissue under a microscope to look for cancer cells. If cancer cells are found, the doctor may remove as much tumor as safely possible during the same surgery. The pathologist checks the cancer cells to find out the type and grade of brain tumor. The grade of the tumor is based on how abnormal the cancer cells look under a microscope and how quickly the tumor is likely to grow and spread.



The following test may be done on the sample of tissue that is removed:

- **Immunohistochemistry:** A laboratory test that uses antibodies to check for certain antigens (markers) in a sample of a patient's tissue. The antibodies are usually linked to an enzyme or a fluorescent dye. After the antibodies bind to a specific antigen in the tissue sample, the enzyme or dye is activated, and the antigen can then be seen under a microscope. This type of test is used to help diagnose cancer and to help tell one type of cancer from another type of cancer.

### Some childhood brain and spinal cord tumors are diagnosed by imaging tests.

Sometimes a biopsy or surgery cannot be done safely because of where the tumor formed in the brain or spinal cord. These tumors are diagnosed based on the results of imaging tests and other procedures.

### Certain factors affect prognosis (chance of recovery).

The prognosis depends on the following:

- Whether there are any cancer cells left after surgery.
- The type of tumor.
- Where the tumor is in the body.
- The child's age.
- Whether the tumor has just been diagnosed or has recurred (come back).

## Treatment of Newly Diagnosed and Recurrent Childhood Brain and Spinal Cord Tumors

The brain and spinal cord are made of different kinds of cells. Childhood brain tumors and spinal cord tumors can be benign or malignant and are grouped and treated based on the type of cell the tumor formed in and where the tumor began growing in the central nervous system (CNS). Some types of tumors are divided into subtypes based on how the tumor looks under a microscope and whether it has certain gene changes. See the list below for more information about staging and treatment of newly diagnosed and recurrent childhood brain and spinal cord tumors.

### Childhood Astrocytomas

See the PDQ summary on [Childhood Astrocytomas Treatment](#) for more information on astrocytomas, gliomas, xanthroastrocytomas, and neurofibromatosis type 1 (NF1).

### Childhood Brain Stem Glioma

See the PDQ summary on [Childhood Brain Stem Glioma Treatment](#) for more information on diffuse intrinsic pontine gliomas and focal gliomas.

### Childhood CNS Atypical Teratoid/Rhabdoid Tumor

See the PDQ summary on [Childhood Central Nervous System Atypical Teratoid/Rhabdoid Tumor Treatment](#) for more information.

### Childhood CNS Germ Cell Tumor

See the PDQ summary on [Childhood Central Nervous System Germ Cell Tumors Treatment](#) for more information on germinomas, embryonal carcinomas, yolk sac tumors, choriocarcinoma, mature teratomas, immature teratomas, teratoma with malignant transformation, and mixed germ cell tumors.

### Childhood Craniopharyngioma

See the PDQ summary on [Childhood Craniopharyngioma Treatment](#) for more information.

### Childhood Ependymoma

See the PDQ summary on [Childhood Ependymoma Treatment](#) for more information.

### Childhood Medulloblastoma and Other CNS Embryonal Tumors

See the PDQ summary on [Childhood Medulloblastoma and Other Central Nervous System Embryonal Tumors Treatment](#) for more information on medulloblastomas, embryonal tumors, and pineoblastomas.

## To Learn More About Childhood Brain and Spinal Cord Tumors

For more information about childhood brain and spinal cord tumors, see the following:

- [Pediatric Brain Tumor Consortium \(PBTC\)](#)

For more childhood cancer information and other general cancer resources, see the following:

- [About Cancer](#)
- [Childhood Cancers](#)
- [CureSearch for Children's Cancer](#)
- [Late Effects of Treatment for Childhood Cancer](#)
- [Adolescents and Young Adults with Cancer](#)
- [Children with Cancer: A Guide for Parents](#)
- [Cancer in Children and Adolescents](#)
- [Staging](#)
- [Coping with Cancer](#)
- [Questions to Ask Your Doctor about Cancer](#)
- [For Survivors and Caregivers](#)

## About This PDQ Summary

### About PDQ

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### Purpose of This Summary

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### Clinical Trial Information

A clinical trial is a study to answer a scientific question, such as whether one treatment is better than another. Trials are based on past studies and what has been learned in the laboratory. Each trial answers certain scientific questions in order to find new and better ways to help cancer patients. During treatment clinical trials, information is collected about the effects of a new treatment and how well it works. If a clinical trial shows that a new treatment is better than one currently being used, the new treatment may become "standard." Patients may want to think about taking part in a clinical trial. Some clinical trials are open only to patients who have not started treatment.

Clinical trials can be found online at NCI's website. For more information, call the [Cancer Information Service \(CIS\)](#), NCI's contact center, at 1-800-4-CANCER (1-800-422-6237).

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