CONDITION

Brain tumor - children

Learn about brain tumors in children, including possible symptoms, diagnosis, treatment, complications, and long-term follow-up.

WHAT IT IS
Mass of abnormal cells in the brain

BODY SYSTEM
Nervous system

MAIN SYMPTOMS
Worsening headaches, repeated vomiting, seizures, balance problems

WHAT CAUSES IT
Usually unknown genetic changes

HOW IT IS DIAGNOSED
MRI and tumor tissue examination

MAIN TREATMENT
Surgery, radiation, chemotherapy, targeted therapy

CAN IT BE CURED?
Sometimes - depends on tumor and treatment

IS IT AN EMERGENCY?
Sometimes - prolonged seizure or rapidly declining alertness

LONG-TERM OUTLOOK
Varies widely with possible lasting complications

Overview

A brain tumor is a mass of abnormal cells in the brain or nearby structures. Tumors can also develop in the spinal cord. Together, the brain and spinal cord make up the central nervous system.

Some childhood brain tumors are malignant , meaning cancerous. Others are benign , meaning they do not spread to distant parts of the body. Even a benign tumor can cause serious problems if it presses on important brain tissue, blocks the flow of fluid around the brain, or affects hormone production.

Brain tumors are classified by the cells involved, their genetic and molecular features, and where they grow. Groups include gliomas, medulloblastomas, ependymomas, embryonal tumors, germ cell tumors, and tumors of the pituitary region.

The effects depend on the tumor's location, size, growth rate, and the child's age. For example, a tumor may affect movement, balance, vision, growth, puberty, thirst, or appetite. Treatment and outlook vary widely. Some slow-growing tumors can be monitored, while others need prompt surgery and additional treatment.

Symptoms

Symptoms may develop gradually or over a short period. They can be difficult to recognize in babies and young children who cannot describe how they feel.

Headache is one possible symptom, but most childhood headaches are not caused by a brain tumor. A concerning pattern includes headaches that become more frequent or severe, regularly wake the child, are worse in the morning, or occur with repeated vomiting.

Possible symptoms include:

Babies may have a rapidly increasing head size, bulging soft spot, persistent irritability, poor feeding, vomiting, or reduced alertness. These signs have many possible causes and require medical assessment.

Contact a health professional promptly for a new seizure, persistent unexplained vomiting, progressive weakness, new balance problems, or worsening headaches. A child being treated for a brain tumor also needs prompt assessment for new or worsening neurologic symptoms.

Call emergency services for a prolonged seizure, repeated seizures without recovery, severe difficulty waking the child, sudden loss of movement, major breathing difficulty, or rapidly declining alertness. Follow the child's emergency plan if the care team has provided one.

- Persistent or worsening headaches
- Repeated nausea or vomiting without a clear stomach illness
- New seizures
- Problems with balance, walking, coordination, or handwriting
- Weakness, numbness, or reduced movement on one side
- Vision changes, unusual eye movements, or double vision
- New hearing or speech problems
- Unusual sleepiness, confusion, or changes in behavior or school performance
- Trouble swallowing or frequent choking
- Changes in growth, puberty, thirst, urination, appetite, or weight

- Loss of previously learned skills

Causes and risk factors

In most children, the cause of a brain tumor is unknown. It is usually not related to anything a parent or child did. Brain tumors are not contagious, and ordinary bumps to the head do not cause them.

Tumors develop when changes in a cell's genetic instructions allow abnormal growth. Most of these changes occur only in the tumor and are not inherited.

A small proportion are associated with inherited conditions, including neurofibromatosis type 1 or 2, tuberous sclerosis complex, Li-Fraumeni syndrome, and von Hippel-Lindau disease. Genetic counseling may be offered when the tumor type or family history suggests an inherited condition.

Previous radiation treatment to the head is another risk factor, mainly for children treated for an earlier cancer or medical condition. Most affected children, however, have no known inherited syndrome or preventable risk factor.

Diagnosis

Diagnosis begins with a medical history and physical examination. The clinician will ask about the symptoms, when they began, whether they are worsening, and how they affect sleep, school, movement, vision, behavior, or development.

A neurologic examination may assess strength, reflexes, balance, coordination, sensation, speech, eye movements, and alertness. Vision, hearing, growth, and signs of hormone problems may also be checked.

MRI is the main imaging test for the brain and spinal cord. It uses a strong magnetic field rather than ionizing radiation. Contrast material may be injected into a vein to improve the images. Young children may need sedation or anesthesia to remain still. Families should follow all instructions about eating, drinking, medicines, and arrival time before sedation or anesthesia.

CT produces images quickly and may be used in an emergency or when MRI is unavailable. It uses X-rays, so clinicians consider radiation exposure when choosing a test.

Imaging may suggest a tumor type, but tissue is often needed for a final diagnosis. Surgeons may remove part or all of the tumor. A pathologist then examines the tissue and tests for molecular changes that help classify the tumor and guide treatment.

Additional tests may include blood or hormone tests, eye and hearing examinations, or spinal imaging. A lumbar puncture may be used for selected tumor types to examine fluid around the brain and spinal cord. It is not safe or appropriate in every case and is performed only when the medical team determines that it can be done safely.

Treatment and management

Treatment depends on the tumor's type, molecular features, grade, location, size, and whether it has spread within the central nervous system. The child's age, health, symptoms, and previous treatments also matter.

Care usually involves a multidisciplinary team that may include pediatric neurosurgeons, oncologists, radiation oncologists, neurologists, radiologists, pathologists, endocrinologists, rehabilitation professionals, nurses, psychologists, and social workers. Consultation at a pediatric brain tumor center may be helpful.

Surgery is often the first treatment. Its goals may include obtaining tissue, relieving pressure, restoring fluid flow, and removing as much tumor as is safely possible. Complete removal may not be possible if the tumor involves areas controlling breathing, movement, speech, vision, or other essential functions.

If fluid builds up in the brain, a surgeon may place a temporary drain or a shunt that redirects fluid elsewhere in the body. Another procedure may create an opening within the brain's fluid spaces.

Radiation therapy uses high-energy beams to damage tumor cells. Treatment is planned to limit exposure to healthy tissue. Whether and when it is used depends partly on the child's age and tumor type. Proton therapy may reduce exposure to some nearby tissues but is not appropriate for every tumor.

Chemotherapy uses medicines to kill or slow tumor cells. It may be given after surgery, with radiation, or to delay radiation in younger children. Possible effects include low blood counts, infection risk, nausea, fatigue, and damage to specific organs, depending on the medicines used.

Targeted therapies act on particular molecular changes that help some tumors grow. Testing can show whether a tumor may respond, but targeted therapy is not available or suitable for every child.

Some slow-growing tumors can be managed with active surveillance using scheduled examinations and scans. Supportive care may include medicines for swelling, seizures, nausea, or pain, along with physical, occupational, speech, vision, hearing, educational, or psychological

support. An appropriate clinical trial may also be offered.

Complications

Complications can result from the tumor, increased pressure inside the skull, surgery, or other treatments. They may include seizures, weakness, balance problems, vision or hearing loss, swallowing or speech difficulty, and changes in memory, attention, processing speed, mood, or behavior.

Tumors and treatments near the pituitary gland or hypothalamus may affect growth, puberty, thyroid function, stress hormones, thirst, and weight regulation. Radiation and some medicines can also affect learning, fertility, blood vessels, hearing, kidneys, blood counts, or other organs. Certain effects may appear years later, including a treatment-related second cancer.

Surgery near the back of the brain can sometimes cause posterior fossa syndrome, also called cerebellar mutism syndrome. Symptoms may include reduced speech, swallowing problems, low muscle tone, emotional changes, and poor coordination. Recovery varies, and rehabilitation may be needed.

Follow up

Follow-up continues after active treatment. Visits generally include symptom review, neurologic examination, and MRI scans scheduled according to the tumor and treatment history. Scans may become less frequent if the condition remains stable.

Monitoring may also cover growth, puberty, hormone levels, vision, hearing, learning, emotional health, and physical function. School assessments or neuropsychological testing can identify changes in memory, language, attention, or processing speed so support can begin early.

Families should receive a treatment summary and survivorship care plan when available. These documents record the diagnosis, surgery, medicines, radiation exposure, and recommended long-term monitoring, and can support the eventual transition to adult care.

Between visits, contact the care team about new or worsening headaches, repeated vomiting, seizures, weakness, balance changes, unusual sleepiness, vision changes, or loss of skills. Do not wait for the next routine appointment. Seek emergency care for prolonged or repeated seizures, severe difficulty waking, sudden major weakness, breathing problems, or rapidly worsening alertness.

Sources

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