CONDITION

Neuroblastoma

Neuroblastoma is a childhood cancer that develops from immature nerve cells.

WHAT IT IS
Cancer of immature nerve cells, mainly in children

BODY SYSTEM
Nervous system and hormone-producing adrenal glands

MAIN SYMPTOMS
Abdominal swelling, bone pain, tiredness, reduced appetite

WHAT CAUSES IT
Usually unknown; rarely inherited gene changes

HOW IT IS DIAGNOSED
Tumor biopsy with imaging and bone marrow staging

MAIN TREATMENT
Surgery, chemotherapy, radiation, stem cell transplant, immunotherapy

CAN IT BE CURED?
Sometimes - more likely with lower-risk tumors

IS IT AN EMERGENCY?
Sometimes - weakness, breathing trouble, or treatment-related fever

LONG-TERM OUTLOOK
Often good for lower-risk; high-risk can recur

Overview

Neuroblastoma is a cancer that begins in immature nerve cells called neuroblasts. These cells normally develop into parts of the sympathetic nervous system, which helps control automatic functions such as heart rate and blood pressure.

Most neuroblastomas begin in an adrenal gland above a kidney or in nerve tissue along the spine. They can also start in the chest, neck, or pelvis. Although its name contains "neuro," neuroblastoma is not usually a brain tumor.

The condition mainly affects babies and young children, but it can occur in older children and, rarely, adults. Some tumors remain in one area. Others spread to lymph nodes, bones, bone marrow, liver, skin, or other parts of the body.

Neuroblastoma does not behave the same way in every child. Some small tumors in infants can

shrink without intensive treatment. Other tumors grow or spread quickly. Doctors place the condition into a risk group using the child's age, the tumor's location and spread, its appearance under a microscope, and genetic features within the tumor. The risk group guides treatment and gives a more useful picture of outlook than stage alone.

Symptoms

Symptoms depend on where the tumor is, how large it has become, and whether it has spread. Many symptoms can also be caused by conditions that are much more common than neuroblastoma.

A tumor in the abdomen may cause a firm lump, swelling, pain, constipation, or a feeling of fullness. A child may eat less or lose weight. A tumor in the chest can cause coughing, noisy breathing, shortness of breath, or difficulty swallowing.

When neuroblastoma affects bones or bone marrow, it may cause bone pain, limping, pale skin, tiredness, bruising, or frequent infections. Tumor spread around the eyes can cause swelling, dark discoloration resembling bruises, or eyes that appear to bulge.

A tumor pressing on the spinal cord may cause back pain, leg weakness, difficulty walking, or loss of bladder or bowel control. These symptoms need urgent assessment because early treatment can help limit lasting nerve damage.

Some tumors release substances related to adrenaline. This can contribute to sweating, a fast heartbeat, flushing, or high blood pressure. Rarely, a child develops frequent watery diarrhea.

A small number of children develop rapid, irregular eye movements with jerking movements, poor balance, or loss of previously learned skills. This is called opsoclonus-myoclonus-ataxia syndrome. It is thought to result from the immune system reacting to both the tumor and parts of the nervous system.

Causes and risk factors

Neuroblastoma begins when genetic changes cause an immature nerve cell to keep growing instead of developing normally. In most children, it is not clear why these changes happen. Nothing a parent did during pregnancy is known to cause neuroblastoma, and it is not caused by an infection, diet, or injury.

Most cases are not inherited. In a small minority of families, a gene change passed from a parent increases the chance of developing neuroblastoma. Inherited changes involving genes such as ALK or PHOX2B may be responsible. A family pattern may include more than one

affected relative, tumors in both adrenal glands, or more than one separate tumor.

Young age is strongly linked with neuroblastoma because the cells involved are part of early nervous system development. This is not a preventable risk factor.

If the medical team suspects an inherited form, genetic counselling can help the family understand testing, what results may mean for relatives, and whether specialist monitoring is appropriate.

Diagnosis

Assessment usually begins with a medical history and physical examination. Blood tests can check blood cell counts and how the liver, kidneys, and other organs are working.

Most neuroblastomas make chemicals called catecholamines. The body breaks these down into substances including homovanillic acid, or HVA, and vanillylmandelic acid, or VMA. A urine test can measure these substances. An abnormal result supports the diagnosis, but it does not usually confirm it on its own.

Ultrasound, CT, or MRI scans help show where the tumor started and whether it is pressing on nearby structures. MRI is particularly useful for examining the spine.

An MIBG scan is commonly used to look for neuroblastoma throughout the body. MIBG is a mildly radioactive substance that many neuroblastoma cells absorb. A different scan, such as PET, may be used when the tumor does not absorb MIBG.

A biopsy usually confirms the diagnosis. During a biopsy, a specialist removes a small sample of the tumor so it can be examined under a microscope. The sample is also tested for biological and genetic features, including changes involving the MYCN gene. These features can affect how the tumor is expected to behave.

Bone marrow samples may be taken from the hip bones to look for spread. The child's age, imaging results, biopsy findings, and tumor biology are then combined to assign a stage and risk group.

Treatment and management

Treatment is planned by a team experienced in childhood cancer. The plan is based on the risk group, tumor location, symptoms, and the child's overall health.

Some infants with a small, favourable tumor can be watched closely with examinations, scans, and laboratory tests. This is called observation. It is used only in carefully selected situations

because some neuroblastomas can mature or shrink without treatment.

Surgery may be the only treatment needed for some tumors that have not spread. If removing the whole tumor could injure important nerves, blood vessels, or organs, the surgeon may leave part of it in place. Complete removal is not always necessary for lower-risk neuroblastoma.

Intermediate-risk treatment often combines chemotherapy with surgery. Chemotherapy uses medicines that travel through the body to kill cancer cells. It may be given before surgery to shrink the tumor or afterward to treat remaining cells.

High-risk neuroblastoma usually needs several forms of treatment over many months. Treatment may include:

Supportive care is part of treatment. It may include medicines for nausea and pain, blood or platelet transfusions, infection treatment, nutrition support, physical therapy, and emotional support.

If neuroblastoma returns or does not respond as expected, options may include different chemotherapy, targeted or radioactive MIBG treatment, immunotherapy, radiation, surgery, or a clinical trial. The choice is based on earlier treatment and the location and biology of the returning tumor.

- Intensive chemotherapy followed by surgery
- High-dose chemotherapy with the child's own stored blood-forming stem cells
- Radiation directed at the original tumor or other selected areas
- Immunotherapy that helps the immune system recognize neuroblastoma cells
- A retinoid medicine that encourages remaining cells to mature

Complications

The tumor can press on nearby organs, blood vessels, airways, or nerves. Spinal cord compression is one of the most urgent complications because it may affect movement and bladder or bowel function.

Spread to bone marrow can reduce the production of healthy blood cells. This may lead to anemia, which causes tiredness or pale skin; low platelets, which increase bruising or bleeding; or low infection-fighting cells.

Treatment can also cause complications. Short-term effects may include nausea, mouth sores, hair loss, tiredness, infection risk, and changes in blood counts. The exact effects differ

between treatments.

Possible long-term effects include hearing loss, kidney or thyroid problems, changes in growth, reduced fertility, heart problems, learning difficulties, and a small risk of another cancer later in life. Not every child develops these effects. Follow-up is matched to the treatments received so that problems can be found and managed early.

Opsoclonus-myoclonus-ataxia symptoms may continue even after the tumor is treated. Some children need longer-term neurological, developmental, rehabilitation, or educational support.

Prevention

There is no known way to prevent most neuroblastomas. The genetic changes usually arise without an identifiable cause, and routine lifestyle changes cannot prevent them.

Screening all healthy children for neuroblastoma is not routinely used. Finding very small tumors through population screening has not been shown to provide the expected benefit, partly because some of those tumors would disappear without treatment.

Families with an inherited gene change may be offered genetic counselling and specialist surveillance. Surveillance aims to find a tumor early; it does not prevent one from developing.

Living with it and what to expect

Treatment may last from a short period of observation or recovery after surgery to many months of combined treatment. Children receiving intensive therapy may spend time in hospital and need periods away from nursery or school. Energy, appetite, sleep, and mood can change during treatment.

Many children with lower-risk neuroblastoma are cured, sometimes with surgery alone or limited chemotherapy. High-risk neuroblastoma is harder to treat and can return after an initial response. Tumor biology, age, spread, and response to treatment all influence the outlook.

After treatment, follow-up visits continue for years. Early visits often focus on whether the tumor has returned and how the child is recovering. Later follow-up also checks growth, hearing, learning, puberty, fertility, and the health of organs affected by treatment.

Most children benefit from returning gradually to ordinary routines, including play, school, and time with friends. Some need physical therapy, hearing support, classroom adjustments, or help managing anxiety. A treatment summary can help families and future healthcare teams understand which long-term checks are needed.

Uncertainty around scans and appointments can be difficult. The oncology team, primary care team, school, and psychosocial services can work together to support both the child and family over time.

When to get medical help

Arrange a medical assessment if your child has a persistent or growing lump, unexplained abdominal swelling, ongoing bone pain, a new limp, unusual tiredness, unexplained bruising, or symptoms that continue or worsen. These symptoms do not necessarily mean neuroblastoma, but they should be checked.

Seek urgent medical help for new weakness, difficulty walking, severe back pain, or new loss of bladder or bowel control. These can be signs that a tumor is pressing on the spinal cord.

Emergency assessment is also appropriate for severe breathing difficulty, collapse, a seizure, or a child who is very difficult to wake.

During cancer treatment, fever can be a sign of a serious infection when infection-fighting blood cells are low. Follow the oncology team's exact temperature threshold and contact instructions immediately. Do not wait for a routine appointment.

For non-urgent concerns during treatment or follow-up, such as reduced appetite, mild pain, sleep problems, or school difficulties, contact the regular cancer care team. These issues often have practical treatments and support options.

Common questions

Is neuroblastoma a type of cancer?

Yes. It is a cancer of immature cells from the sympathetic nervous system. It is different from adult nerve cancers and from most brain tumors.

Is neuroblastoma hereditary?

Usually not. Most children have no family history, and the genetic changes are found only within the tumor. A small minority have an inherited change, most often involving genes such as ALK or PHOX2B .

Can neuroblastoma go away on its own?

Some small tumors in carefully selected infants can shrink or mature without treatment. Doctors may monitor these tumors closely. It is not safe to assume that any neuroblastoma will disappear without specialist assessment.

Can adults get neuroblastoma?

Yes, but it is rare. Diagnosis and treatment in adults may differ because most evidence and treatment systems are based on childhood neuroblastoma.

Can neuroblastoma come back after treatment?

It can. Recurrence is more common with high-risk neuroblastoma than with lower-risk tumors. Follow-up scans, examinations, and tests are planned according to the original risk and treatment.

How is neuroblastoma different from a brain tumor?

Neuroblastoma usually starts in sympathetic nerve tissue outside the brain, often in an adrenal gland or along the spine. Despite the similar name, it is not the same as tumors that begin in the brain.

Sources

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