CONDITION

Von recklinghausen's neurofibromatosis

An inherited condition that causes skin changes and usually non-cancerous tumours along nerves.

WHAT IT IS
Inherited condition causing nerve-related tumours and skin changes

BODY SYSTEM
Nervous system, skin, bones, eyes, and blood vessels

MAIN SYMPTOMS
Café-au-lait spots, freckles, neurofibromas, learning difficulties

WHAT CAUSES IT
Inherited or new change in the NF1 gene

HOW IT IS DIAGNOSED
Clinical criteria, sometimes NF1 genetic testing

MAIN TREATMENT
Monitoring, symptom treatment, surgery, and targeted medicines

CAN IT BE CURED?
No, the gene change remains lifelong

IS IT AN EMERGENCY?
Sometimes, with sudden weakness, severe pain, or vision loss

LONG-TERM OUTLOOK
Often manageable, though complications can sometimes be serious

Overview

Von Recklinghausen's neurofibromatosis is now usually called neurofibromatosis type 1 , or NF1 . It is a lifelong genetic condition affecting the skin, nerves, eyes, bones, and sometimes blood vessels.

NF1 can cause tumours called neurofibromas to grow from the protective covering of nerves. Most neurofibromas are benign, meaning they are not cancer. They may still cause pain, pressure, changes in appearance, or problems with how a nerve works.

The condition can look very different from one person to another, including within the same family. Some people mainly have skin markings and need regular checks. Others develop learning difficulties, bone problems, vision problems, or tumours that require treatment.

Features also change with age. Café-au-lait spots often appear in early childhood, while many skin neurofibromas develop around puberty or adulthood. Lifelong follow-up matters because some complications can be treated more effectively when found early.

Symptoms

Café-au-lait spots are often the first sign. These are flat, light-brown patches on the skin. One or two spots are common in people without NF1, so the number, size, and presence of other features are important.

Freckling may appear in areas not usually exposed to sunlight, especially the armpits or groin.

Neurofibromas are soft or firm lumps arising from nerves. Small cutaneous neurofibromas grow on or just under the skin. They may catch on clothing, itch, feel tender, or affect confidence, but they are usually harmless.

Plexiform neurofibromas grow along a larger nerve and may involve nearby tissues. They are often present from birth, although they may not be noticed until later. Depending on their location, they can cause pain, weakness, altered growth, or changes in appearance.

Other possible features include:

Many children with NF1 have normal intelligence. However, specific learning difficulties and attention-deficit hyperactivity disorder are more common and may affect schoolwork.

- Learning, attention, speech, or coordination difficulties
- Headaches, seizures, or weakness
- Curving of the spine, called scoliosis
- Bowing of a leg or poor healing of a broken bone
- High blood pressure
- Reduced vision, changes in colour vision, or an eye that bulges forward
- Small, harmless spots on the coloured part of the eye, called Lisch nodules
- Earlier or later puberty than expected

Causes and risk factors

NF1 is caused by a change in the NF1 gene . This gene normally helps control cell growth. When it does not work as expected, cells around nerves can grow into neurofibromas and other

tumours.

NF1 is autosomal dominant . This means a person with the condition has a 1 in 2 chance of passing the altered gene on in each pregnancy. The chance is the same whether the affected parent is the mother or father.

About half of people with NF1 inherit the gene change from a parent. In the others, it begins as a new genetic change in the egg, sperm, or early embryo. Nothing a parent did before or during pregnancy causes this change.

The type or severity of NF1 in a child cannot usually be predicted from the parent's symptoms. One family member may have mild skin findings while another has more significant complications.

NF1 affects people of all sexes and backgrounds. It is not contagious.

Diagnosis

NF1 is often diagnosed from a medical and family history, skin examination, eye assessment, and other physical findings. Features may appear gradually, so a young child may need follow-up before the diagnosis becomes clear.

The internationally agreed diagnostic criteria include:

Usually, at least two criteria are required. A child whose parent has confirmed NF1 may be diagnosed with one additional criterion.

Genetic testing can support the diagnosis when the physical signs are uncertain. It may also help with testing relatives or planning a pregnancy. A negative test does not always completely exclude NF1.

MRI scans are used when symptoms or examination findings suggest a tumour or another complication. Routine scanning of every part of the body is not automatically needed. Eye examinations, blood pressure checks, growth assessment, bone examination, and reviews of development or learning are important parts of follow-up.

- Six or more café-au-lait spots meeting specific size limits
- Freckling in the armpits or groin
- Two or more neurofibromas, or one plexiform neurofibroma
- An optic pathway glioma, which is a tumour affecting the vision pathway
- Characteristic findings inside the eye

- A distinctive NF1-related bone problem
- A disease-causing change in the NF1 gene
- A parent who meets the diagnostic criteria

Treatment and management

There is no treatment that removes the NF1 gene change. Care focuses on monitoring, treating symptoms, and managing complications.

Regular reviews may include checks of the skin, vision, blood pressure, spine, limb development, puberty, pain, and nervous system. Children should also have their learning, behaviour, growth, and development reviewed.

Neurofibromas do not always require treatment. A troublesome skin neurofibroma may be removed using minor surgery or another skin procedure. Removal can leave a scar, and new neurofibromas may develop elsewhere.

Surgery may be considered for a plexiform neurofibroma that causes pain, weakness, loss of function, disfigurement, or concern about cancer. Complete removal is not always possible because these tumours may wrap around nerves, blood vessels, or organs.

Medicines called MEK inhibitors can shrink some symptomatic plexiform neurofibromas that cannot be removed safely. Eligibility depends on factors such as age, tumour behaviour, symptoms, and local approval. These medicines need specialist supervision because they can cause significant side effects.

Other care is tailored to the problem. It may include pain management, physiotherapy, treatment for attention or learning difficulties, educational support, bone surgery, seizure treatment, or treatment of the cause of high blood pressure.

NF1 care may involve genetics, neurology, dermatology, eye care, orthopaedics, oncology, pain services, and psychology.

Complications

Most NF1-related tumours remain benign. A plexiform neurofibroma can sometimes change into a cancer called a malignant peripheral nerve sheath tumour . Warning signs include rapid growth, a new hard area, persistent or worsening pain, night pain, weakness, or loss of feeling.

An optic pathway glioma is a tumour along the nerves carrying visual information from the eyes to the brain. Many cause no symptoms, but some affect vision or hormone development.

They occur mainly in children.

Other possible complications include:

These complications do not affect everyone. Routine follow-up is meant to identify concerning changes without assuming that every lump or symptom is serious.

- Persistent nerve or musculoskeletal pain
- Scoliosis or weakness in a bone
- Hearing, movement, or seizure problems
- High blood pressure from kidney artery narrowing or a hormone-producing tumour
- Learning, attention, or emotional difficulties
- Tumours involving the brain, spinal cord, or other nerves
- Increased risk of certain cancers, including breast cancer in women with NF1

Prevention

NF1 itself cannot usually be prevented. It results from an inherited or new genetic change, not from lifestyle, food, infection, or something done during pregnancy.

Genetic counselling can explain inheritance and reproductive options. These may include testing during pregnancy or testing embryos created through in vitro fertilisation. These are personal choices and do not change NF1 in someone who already has it.

Complications cannot all be prevented, but regular reviews can help find problems earlier. Reporting changes in a known tumour, attending eye checks, monitoring blood pressure, and arranging learning support when needed can reduce the effect of some complications.

Living with it and what to expect

NF1 is lifelong, but its course is unpredictable. Many people attend school, work, have relationships, and live independently. Others need ongoing support for pain, disability, learning difficulties, or complex tumours.

Café-au-lait spots usually remain. Freckling often becomes more noticeable during childhood. Skin neurofibromas commonly increase in number during adulthood and may grow during puberty or pregnancy. They do not usually disappear without treatment.

Plexiform neurofibromas may remain stable or grow. Growth can be faster in childhood, but a sudden change at any age needs assessment. Learning difficulties often become clearer when

school demands increase rather than because the condition is rapidly worsening.

Follow-up changes over time. Children generally need attention to vision, development, growth, bones, and puberty. Adult care places greater focus on blood pressure, pain, tumour changes, function, pregnancy, and cancer risk.

Pregnancy is possible for many people with NF1. Neurofibromas may increase in size or number, and high blood pressure needs careful monitoring. Pre-pregnancy genetic counselling and coordinated maternity care can be helpful.

NF1 can affect body image, confidence, relationships, and mental health. Psychological support and contact with an NF1 support organisation may help. The outlook for one person cannot be predicted from photographs, the number of skin tumours, or another family member's experience.

When to get medical help

Arrange a routine review if you notice a new lump, changes in existing neurofibromas, increasing pain, persistent headaches, changes in growth, or new problems with learning, attention, sleep, or mood. These symptoms usually do not require emergency care, but they deserve assessment.

Seek prompt medical advice for:

Call emergency services for sudden loss of vision, sudden one-sided weakness, a first seizure, loss of consciousness, severe breathing difficulty, or a rapidly worsening neurological problem.

- A lump that grows quickly, becomes hard, or causes persistent pain
- New weakness, numbness, poor balance, or difficulty walking
- Changes in eyesight, colour vision, or eye position
- New or worsening bone pain, spinal curvature, or limb bowing
- Repeated severe headaches or symptoms of very high blood pressure
- Early puberty or an unexpected change in growth

Common questions

Is NF1 cancer?

No. NF1 is a genetic condition, and most neurofibromas are non-cancerous. People with NF1 do have a higher risk of certain cancers, so a rapidly changing, hard, or persistently painful tumour

should be assessed promptly.

Can café-au-lait spots occur without NF1?

Yes. A small number of café-au-lait spots can occur in people without NF1. Diagnosis depends on the number and size of the spots, other clinical findings, family history, and sometimes genetic testing.

Will my child inherit NF1 from me?

Each child of a parent with NF1 has a 1 in 2 chance of inheriting the altered gene. The severity cannot be reliably predicted. A child who does not inherit the gene change will not pass that family change to their children.

Do all neurofibromas need to be removed?

No. Many do not cause medical problems and can be monitored. Removal may be considered for pain, repeated irritation, loss of function, significant effects on appearance, or concern about tumour behaviour.

Does NF1 get worse with age?

Some visible features, especially skin neurofibromas, often increase with age. This does not mean that everyone develops serious complications. New pain, rapid tumour growth, weakness, or vision changes are more important than the number of stable skin lumps.

Can someone with NF1 have a normal life?

Many people with NF1 lead active and independent lives. The support needed differs because the condition ranges from mild skin findings to significant neurological, bone, learning, or tumour-related problems. Regular follow-up helps care adapt as needs change.

Sources

- Legius E, Messiaen L, Wolkenstein P, and colleagues. "Revised diagnostic criteria for neurofibromatosis type 1 and Legius syndrome: an international consensus recommendation." Genetics in Medicine . 2021;23:1506-1513.
- Miller DT, Freedenberg D, Schorry E, Ullrich NJ, Viskochil D, Korf BR. "Health Supervision for Children With Neurofibromatosis Type 1." Pediatrics . 2019;143(5):e20190660.
- Carton C, Evans DG, Blanco I, and colleagues. "ERN GENTURIS tumour surveillance guidelines for individuals with neurofibromatosis type 1." eClinicalMedicine . 2023;56:101818.
- Friedman JM. "Neurofibromatosis 1." GeneReviews , University of Washington, Seattle.

- National Institute of Neurological Disorders and Stroke. "Neurofibromatosis." U.S. National Institutes of Health.
- U.S. Food and Drug Administration. Koselugo (selumetinib) prescribing information . AstraZeneca.