CONDITION

Periventricular leukomalacia

Periventricular leukomalacia is an injury to brain white matter that mainly affects babies born prematurely.

WHAT IT IS
Brain white-matter injury around fluid-filled spaces

BODY SYSTEM
Nervous system

MAIN SYMPTOMS
Delayed development, stiff muscles, movement difficulties, vision problems

WHAT CAUSES IT
Reduced brain blood flow, oxygen shortage, or inflammation

HOW IT IS DIAGNOSED
Brain ultrasound and MRI

MAIN TREATMENT
Developmental therapies and symptom-focused care

CAN IT BE CURED?
No - damaged brain tissue cannot be restored

IS IT AN EMERGENCY?
Sometimes - a first or prolonged seizure needs emergency care

LONG-TERM OUTLOOK
Stable brain injury with effects ranging from mild to severe

Overview

Periventricular leukomalacia, often shortened to PVL, is an injury to the brain's white matter. White matter contains nerve fibres that carry messages between different parts of the brain. "Periventricular" means around the ventricles, which are spaces in the brain filled with fluid.

PVL mainly occurs in babies born prematurely because their developing white matter is especially sensitive to changes in blood flow, oxygen, and inflammation. It can also occur in babies born at or near full term, although this is less common.

The injury may affect small areas or be more widespread. Some babies develop fluid-filled spaces called cysts where tissue has been damaged. Other injuries are more diffuse and may be easier to see on magnetic resonance imaging, or MRI.

PVL is a condition caused by an earlier brain injury. It is not contagious, and the original injury does not keep spreading through the brain. However, its effects may become clearer as a child grows and is expected to develop new movement, language, learning, and social skills.

PVL matters because the affected white matter helps control movement, vision, attention, and other abilities. Some children have few noticeable difficulties. Others develop cerebral palsy, developmental delays, vision problems, epilepsy, or a combination of these.

Symptoms

PVL may not cause obvious symptoms in a newborn baby. In many cases, it is first found on a brain scan performed because the baby was born very early or needed intensive care.

Signs may appear gradually during infancy or early childhood. They can include:

Movement problems often affect the legs more than the arms. A pattern called spastic diplegia causes muscle stiffness mainly in both legs and is one form of cerebral palsy associated with PVL. Other movement patterns are possible.

The scan findings do not predict every symptom. A child with a small injury may still need support in a specific area, while another child with noticeable scan changes may make more developmental progress than expected.

- Delayed head control, rolling, sitting, crawling, or walking
- Muscles that feel unusually stiff, tight, weak, or floppy
- Legs that cross or "scissor" when the child is lifted
- Difficulty coordinating movement or using both sides of the body
- Problems tracking objects or responding to visual information
- Feeding, swallowing, speech, attention, or learning difficulties
- Seizures

Causes and risk factors

PVL develops when immature white matter cells are injured. This can happen when the brain receives too little blood or oxygen, or when inflammation damages vulnerable cells. These processes may happen before birth, around the time of delivery, or during newborn intensive care.

Premature birth is the strongest risk factor. The earlier a baby is born, the more vulnerable the

developing white matter is. Blood vessels in this area are still maturing and may have difficulty maintaining a steady supply of blood and oxygen.

Other circumstances linked with a higher risk include serious infection or inflammation around the time of birth, unstable blood pressure, severe breathing problems, and certain complications of prematurity. Bleeding into or near the brain's ventricles may occur alongside white-matter injury.

Having a risk factor does not mean a baby will develop PVL. It is also not always possible to identify one event that caused the injury. Parents usually did not do anything to cause it.

Diagnosis

PVL is confirmed with brain imaging. A physical examination or developmental assessment can identify difficulties linked with the condition, but it cannot show the white-matter injury itself.

Cranial ultrasound is often the first test. It uses sound waves through the soft spot on a baby's head to produce images of the brain. It can be performed at the bedside and repeated safely. Some injuries, especially cysts, take time to become visible, so babies at risk may have more than one scan.

MRI uses a strong magnet and radio waves to produce detailed brain images. It can show the location and extent of white-matter injury, including changes that may not be visible on ultrasound. MRI does not use X-rays, but a baby may need careful preparation to remain still.

A scan may confirm PVL, but it cannot give an exact forecast of a child's abilities. Developmental evaluations, movement assessments, vision and hearing tests, and follow-up over time provide additional information.

Clinicians may also look for other explanations if a child's symptoms do not fit the scan findings. Loss of previously acquired skills, for example, is not typical of a stable injury and needs further assessment.

Treatment and management

There is no treatment that can restore white matter already damaged by PVL. Management focuses on supporting development, helping the child use their abilities, and treating specific problems.

Early support may begin before all long-term effects are known. Depending on the child's

needs, care may involve:

If cerebral palsy develops, treatment may include therapies and measures to manage muscle stiffness or abnormal movement. Some children benefit from medication, injections, orthopaedic care, or surgery. These options address particular symptoms; they do not reverse PVL.

Seizures may be treated with anti-seizure medicine. The choice of treatment is based on the seizure type, test results, age, and other health needs.

Care is usually coordinated through newborn follow-up services, primary care, developmental specialists, rehabilitation teams, or neurology services. The mix of support can change as the child grows.

- Physical therapy for strength, posture, balance, and movement
- Occupational therapy for play, dressing, eating, and daily activities
- Speech and language therapy for communication or swallowing
- Vision and hearing services
- Feeding and nutrition support
- Learning and behavioural support
- Mobility equipment, braces, or other adaptive devices

Complications

Cerebral palsy is one of the best-known complications of PVL, but it does not develop in every child. It affects movement and posture and can range from mild stiffness to significant difficulty controlling the body.

Other possible complications include:

Vision difficulties may occur even when the eyes themselves are healthy. This is because PVL can affect nerve pathways that carry and process visual information.

Some complications become noticeable only when tasks grow more complex. School may reveal difficulties with handwriting, visual-spatial skills, attention, or processing information that were not obvious during infancy.

- Delayed motor, language, thinking, or social development
- Visual impairment, including difficulty interpreting what is seen
- Epilepsy

- Feeding or swallowing difficulties
- Speech and communication problems
- Attention, planning, processing-speed, or learning difficulties
- Tight muscles, reduced joint movement, or changes in bone alignment

Prevention

PVL cannot always be prevented. In many cases, there is no single avoidable event, and some of the circumstances leading to very premature birth cannot be controlled.

Maternity and newborn teams try to reduce the risk of premature birth when possible and protect a premature baby's breathing, circulation, temperature, and nutrition. They also monitor for infection and other complications. These measures may lower the chance of further injury, but they cannot guarantee that PVL will not occur.

Following recommended prenatal care can help identify pregnancy complications and signs of early labour. However, a diagnosis of PVL does not mean prenatal or newborn care was inadequate. Parents should not assume they caused the condition through an everyday action or omission.

Living with it and what to expect

PVL itself is a non-progressive injury, meaning the original area of brain damage does not steadily enlarge. It is not a degenerative condition in which brain tissue continues to break down.

Its effects can still change over months and years. A baby's movement differences may become clearer when sitting or walking is expected. Learning or attention difficulties may appear when schoolwork becomes more demanding. Muscle tightness can also lead to secondary joint or bone problems as the body grows.

Some children with PVL walk independently, attend mainstream school, and need support only in certain areas. Others need mobility equipment, communication support, help with daily activities, or ongoing medical care. Imaging alone cannot determine which path an individual child will follow.

Regular developmental follow-up allows support to be adjusted rather than waiting for a child to fall far behind. Follow-up may include growth and feeding reviews, movement assessments, hearing and vision checks, and monitoring of communication, learning, sleep, and emotional

wellbeing.

Progress is often uneven. A child may gain skills more slowly, use a different way to complete tasks, or need equipment to take part. Therapies aim to improve participation and independence, not simply to make movement look typical.

As children become teenagers and adults, planning may shift toward education, employment, mobility, relationships, independent living, and transfer to adult health services. The support required continues to reflect the person's abilities and goals rather than the scan alone.

When to get medical help

Arrange routine follow-up if you notice delayed milestones, persistent muscle stiffness or floppiness, unusual movement patterns, feeding difficulty, or concerns about vision, hearing, speech, behaviour, or learning. Early assessment can identify useful support even before a specific diagnosis is clear.

Seek prompt medical advice if a child suddenly loses a skill they previously used, develops new weakness, has repeated unusual staring or jerking episodes, or begins choking frequently during feeds. These changes are not automatically caused by PVL and may need separate investigation.

Call emergency services for:

Follow an existing seizure emergency plan if one has been provided. PVL itself is not usually an emergency diagnosis, but sudden symptoms may be emergencies for other reasons.

- A first seizure
- A seizure that does not stop promptly or repeats without recovery
- Serious breathing difficulty or blue, grey, or very pale skin
- Unresponsiveness or difficulty waking
- Sudden severe weakness or loss of movement

Common questions

Is periventricular leukomalacia the same as cerebral palsy?

No. PVL is an injury seen in the brain's white matter. Cerebral palsy describes a group of lifelong movement and posture difficulties caused by an early brain disturbance. PVL can lead to cerebral palsy, but some children with PVL do not develop it.

Does PVL get worse with age?

The original brain injury does not normally spread or progressively destroy more tissue. Its effects may become more noticeable as developmental demands increase. Muscle tightness can also cause secondary problems with joints, bones, comfort, or mobility over time.

Can a baby with PVL learn to walk?

Many children with PVL learn to walk independently, while others use braces, walking aids, wheelchairs, or a combination of supports. The outcome is influenced by the location and extent of injury, associated medical problems, and the child's development over time. A scan cannot provide a certain answer by itself.

Will PVL cause an intellectual disability?

Not always. Some children have typical thinking abilities but experience movement or visual difficulties. Others have learning differences or intellectual disability. Skills may also be uneven, with strengths in some areas and difficulties in attention, processing speed, language, or visual-spatial tasks.

Can PVL be detected before birth?

Some severe brain changes may be identified with prenatal ultrasound or fetal MRI, but PVL is more commonly detected after birth. Changes may take days or weeks to become visible, which is one reason babies at risk can receive repeated imaging.

Can PVL be cured?

Current treatments cannot repair the damaged white matter. Therapy, adaptive equipment, educational support, and treatment of complications can still improve function, comfort, communication, and participation in everyday life.

Sources

- MedlinePlus Medical Encyclopedia. Periventricular leukomalacia . U.S. National Library of Medicine
- Canadian Paediatric Society, Fetus and Newborn Committee. Routine imaging of the preterm neonatal brain . Paediatrics & Child Health . 2020
- National Institute for Health and Care Excellence. Developmental follow-up of children and young people born preterm . NICE guideline NG72
- American Academy for Cerebral Palsy and Developmental Medicine. Early detection of cerebral palsy . Care Pathway



- Back SA. White matter injury in the preterm infant: pathology and mechanisms. Acta Neuropathologica . 2017;134:331-349
- Volpe JJ. Brain injury in premature infants: a complex amalgam of destructive and developmental disturbances. The Lancet Neurology . 2009;8(1):110-124