CONDITION

Cerebral hypoxia

Learn how reduced oxygen to the brain can affect the body, what can cause it, how it is treated, and when emergency care is needed.

WHAT IT IS
Reduced oxygen supply to the brain

BODY SYSTEM
Nervous system

MAIN SYMPTOMS
confusion, poor coordination, seizures, loss of consciousness

WHAT CAUSES IT
Breathing or circulation failure

HOW IT IS DIAGNOSED
Clinical assessment, blood tests, brain imaging, EEG

MAIN TREATMENT
Emergency oxygen and circulation support

CAN IT BE CURED?
Sometimes - depends on severity and duration

IS IT AN EMERGENCY?
Yes - especially unconsciousness or stopped breathing

LONG-TERM OUTLOOK
Recovery varies from full function to lasting disability or death

Overview

Cerebral hypoxia means that the brain is not receiving enough oxygen. Brain cells need a steady supply of oxygen and glucose from the blood to work normally. If that supply falls, brain function can change within a short time.

Related terms describe slightly different problems. Cerebral anoxia means a complete lack of oxygen. Cerebral ischemia means reduced blood flow to the brain. These problems often occur together, especially during cardiac arrest or severe loss of blood pressure. Clinicians may call the resulting damage a hypoxic-ischemic brain injury .

The effects depend on how low the oxygen level becomes, how long the problem lasts, and whether blood flow is also reduced. A brief or mild episode may cause confusion, poor coordination, or short-term memory problems. A severe or prolonged episode can cause

seizures, coma, lasting disability, or death.

Cerebral hypoxia is usually the result of another emergency, such as cardiac arrest, choking, drowning, severe breathing failure, or carbon monoxide poisoning. Rapid treatment focuses on restoring breathing, oxygen delivery, and blood circulation while correcting the underlying cause.

Symptoms

Symptoms may begin suddenly or develop as breathing and circulation worsen. A person with mild or early oxygen deprivation may appear restless, inattentive, confused, or unusually sleepy. They may have a headache, dizziness, poor judgment, trouble speaking, or difficulty coordinating movements.

As oxygen deprivation becomes more severe, symptoms can include:

Skin color is not a reliable way to judge oxygen levels. Some people may not appear blue even when they are seriously unwell. In carbon monoxide poisoning, a standard fingertip oxygen monitor can also give a misleadingly normal result.

Call emergency services immediately if someone is unconscious, has stopped breathing, has no pulse, is having a seizure for the first time, or develops sudden severe confusion after choking, drowning, smoke exposure, suspected poisoning, or a heart or breathing problem.

If the person is not breathing normally, begin cardiopulmonary resuscitation, or CPR, if you can do so. Use an automated external defibrillator, or AED, when one is available. Do not enter a dangerous space, such as a smoke-filled room or an area with a possible gas leak, to attempt a rescue.

- Loss of consciousness or inability to wake
- Seizures or repeated jerking movements
- Severe confusion or unusual behavior
- Weak, irregular, or absent breathing
- Blue, gray, or very pale lips and skin
- Loss of bladder or bowel control
- Abnormal stiffness, limpness, or posturing
- No pulse or signs of cardiac arrest

Causes and risk factors

Cerebral hypoxia can occur when breathing stops, the lungs cannot move enough oxygen into the blood, the heart cannot pump blood effectively, or the blood cannot carry enough oxygen.

Cardiac arrest is an important cause. When the heart stops pumping, blood flow to the brain falls sharply. Other circulation-related causes include severe blood loss, shock, dangerous heart rhythms, and very low blood pressure.

Breathing-related causes include choking, suffocation, drowning, severe asthma attacks, advanced lung disease, opioid or sedative overdose, and conditions that weaken the muscles needed for breathing. A blocked airway or serious injury to the chest can also reduce oxygen delivery.

Carbon monoxide interferes with the blood's ability to transport oxygen and also disrupts oxygen use within cells. It may come from fires, faulty heating systems, generators, charcoal grills, engines, or other fuel-burning equipment. Carbon monoxide has no color or smell, so exposure may not be obvious.

Other possible causes include smoke inhalation, severe anemia, complications during anesthesia, electrical injury, strangulation, and exposure to very high altitude. A stroke usually affects blood flow to a particular part of the brain rather than causing global cerebral hypoxia, but both conditions require urgent assessment.

Factors that may increase the chance of a serious outcome include a longer period without effective breathing or circulation, delayed CPR, repeated cardiac arrest, severe low blood pressure, and major illness affecting the heart or lungs. However, outcome cannot be predicted from a single symptom or test.

Diagnosis

Cerebral hypoxia is diagnosed by considering what happened, examining the person, and looking for evidence of impaired oxygen delivery or brain injury. In an emergency, treatment begins before every test result is available.

The medical team first checks the airway, breathing, pulse, blood pressure, heart rhythm, oxygen level, temperature, and blood glucose. They may ask witnesses about choking, submersion, collapse, drug exposure, smoke, seizures, or how long the person was unresponsive. Information about CPR and AED use is also important.

Blood tests may measure oxygen, carbon dioxide, acidity, electrolytes, kidney and liver function, blood cell counts, and signs of organ stress. Testing for carbon monoxide or particular drugs may be needed when exposure is possible. A routine pulse oximeter cannot

reliably rule out carbon monoxide poisoning.

A computed tomography, or CT, scan may look for bleeding, swelling, stroke, or another cause of altered consciousness. Magnetic resonance imaging, or MRI, can sometimes show patterns of oxygen-related injury more clearly, but the timing of the scan affects what can be seen.

An electroencephalogram, or EEG, records the brain's electrical activity. It may detect seizures that do not cause obvious shaking, including seizures in a person who remains unconscious. Clinicians may repeat neurological examinations and tests as medicines wear off and the person's temperature and body chemistry stabilize.

After cardiac arrest, predicting recovery requires care. Sedatives, low body temperature, seizures, organ failure, and metabolic problems can make a person appear less responsive. Specialists generally use several findings over time rather than relying on one examination, blood test, EEG, or scan.

Treatment and management

Treatment starts with restoring oxygen delivery and blood flow. Depending on the situation, this may include opening the airway, providing oxygen, supporting breathing with a mask or ventilator, performing CPR, using an AED, treating a dangerous heart rhythm, or giving fluids and other hospital treatments to support circulation.

The underlying cause must also be treated. A blocked airway may need to be cleared. An opioid overdose may require an opioid-reversal medicine. Severe asthma or another lung condition may need breathing treatments and ventilation support. Major bleeding may require control of the bleeding and blood replacement.

People with suspected carbon monoxide poisoning are removed from the exposure and given high-concentration oxygen. Hyperbaric oxygen therapy, which delivers oxygen in a pressurized chamber, may be considered in selected cases. The decision depends on symptoms, test results, pregnancy status, exposure history, and advice from poison-control or hyperbaric medicine specialists.

After a person's heartbeat returns following cardiac arrest, intensive care focuses on maintaining adequate oxygen, ventilation, blood pressure, and temperature. Fever is avoided because it may increase the brain's demand for oxygen. Clinicians also monitor for seizures and treat them when appropriate. Care is adjusted to the person's condition rather than following one treatment plan for everyone.

Nutrition, skin protection, blood-clot prevention, and treatment of infections or organ problems may be needed during a prolonged hospital stay. Families may be asked about

advance directives and the person's values if the patient cannot communicate.

Recovery may continue after the immediate illness has stabilized. Rehabilitation can involve physical therapy for strength and movement, occupational therapy for daily activities, and speech-language therapy for communication or swallowing. Neuropsychological assessment can identify changes in memory, attention, reasoning, mood, and behavior.

Some people return to their previous level of function. Others need temporary or long-term help with medication management, transportation, finances, work, school, or personal care. The pace of recovery varies and may be difficult to predict early on.

Complications

Possible complications range from mild thinking problems to severe, widespread brain injury. Memory, concentration, processing speed, judgment, balance, vision, speech, and coordination may be affected. Emotional changes can include irritability, anxiety, depression, reduced motivation, or difficulty controlling behavior.

Injury to areas that control movement may cause weakness, stiffness, tremor, or involuntary movements. Swallowing problems can increase the risk of food or liquid entering the lungs. Some people develop seizures after the initial event.

A person with severe injury may remain in a coma or develop a prolonged disorder of consciousness. In the most serious cases, cerebral hypoxia can lead to brain death, which is the permanent loss of all functions of the entire brain, including the brainstem. Brain death is diagnosed through a formal medical process and is different from coma.

Complications may also come from the event that caused the oxygen loss. Examples include heart, kidney, liver, or lung injury after cardiac arrest, or chemical lung injury after smoke inhalation or drowning.

Follow up

Follow-up depends on the cause, severity, and symptoms that remain after hospital care. Appointments may involve primary care, neurology, cardiology, lung specialists, rehabilitation medicine, mental health care, or therapy services.

Routine follow-up should address thinking and memory, sleep, mood, mobility, swallowing, seizures, return to work or school, and the ability to drive safely. Family members may notice changes that the recovering person does not recognize, so their observations can be useful.

Take medicines only as directed, and do not stop seizure or heart medicines without speaking with the prescribing clinician. Ask when exercise, driving, alcohol use, work, and independent living are considered safe. Prevention may include treating the underlying heart or lung condition, using carbon monoxide alarms, following water-safety practices, and receiving help for substance use when relevant.

Seek prompt medical advice for new or worsening headaches, memory problems, weakness, balance changes, mood symptoms, fainting, or possible medication side effects.

Call emergency services for another loss of consciousness, trouble breathing, chest pain with collapse, a seizure lasting several minutes or repeated seizures without recovery, sudden one-sided weakness, or new inability to speak. Possible repeat carbon monoxide exposure also requires immediate movement to fresh air and emergency guidance, without re-entering the suspected area.

Sources

- National Institute of Neurological Disorders and Stroke. Cerebral Hypoxia . National Institutes of Health. Accessed March 8, 2025.
- Panchal AR, Bartos JA, Cabañas JG, et al. Part 3: Adult Basic and Advanced Life Support: 2020 American Heart Association Guidelines for Cardiopulmonary Resuscitation and Emergency Cardiovascular Care . Circulation . 2020;142(16 Suppl 2):S366-S468.
- Nolan JP, Sandroni C, Böttiger BW, et al. European Resuscitation Council and European Society of Intensive Care Medicine Guidelines 2021: Post-resuscitation care . Intensive Care Medicine . 2021;47:369-421.
- Rajajee V, Muehlschlegel S, Wartenberg KE, et al. Guidelines for Neuroprognostication in Adults with Global Hypoxic-Ischemic Brain Injury . Neurocritical Care . 2023;38:533-563.
- Centers for Disease Control and Prevention. Clinical Guidance for Carbon Monoxide Poisoning Following Disasters and Severe Weather . Updated January 8, 2024. Accessed March 8, 2025.