CONDITION

Carbon monoxide poisoning

Learn how carbon monoxide poisoning happens, which symptoms need emergency care, how it is diagnosed and treated, and how to prevent repeat exposure.

WHAT IT IS
Toxic gas poisoning that prevents normal oxygen use

BODY SYSTEM
Blood, brain and heart

MAIN SYMPTOMS
Headache, dizziness, nausea, confusion

WHAT CAUSES IT
Inhaled carbon monoxide from incomplete fuel burning

HOW IT IS DIAGNOSED
Blood carboxyhemoglobin test with co-oximetry

MAIN TREATMENT
High-concentration oxygen therapy

CAN IT BE CURED?
Sometimes, prompt oxygen treatment enables recovery

IS IT AN EMERGENCY?
Yes, with symptoms or significant exposure

LONG-TERM OUTLOOK
Many recover, but severe exposure can cause lasting disability or death

Overview

Carbon monoxide poisoning happens when carbon monoxide builds up in the blood and prevents the body from using oxygen normally. Carbon monoxide, or CO, is a colorless, odorless gas produced when fuels do not burn completely. Common sources include furnaces, generators, fireplaces, vehicle engines, grills, and fuel-burning heaters.

After CO is breathed in, it attaches to hemoglobin, the protein in red blood cells that carries oxygen. It also interferes with how cells use oxygen. The brain and heart are especially sensitive because they need a steady oxygen supply.

Carbon monoxide poisoning can be difficult to recognize. Early symptoms may resemble the flu, a migraine, food poisoning, or fatigue. Unlike many infections, CO poisoning usually does not cause fever. Several people or pets becoming ill in the same building is an important

warning sign.

Suspected exposure requires prompt action. Go outside or to another source of fresh air immediately. Do not stay inside to search for the source, and do not re-enter until emergency personnel say it is safe. Call emergency services if anyone has symptoms, has collapsed, is confused, is pregnant, or may have had a significant exposure. In the United States, Poison Control can also be reached at 1-800-222-1222, but severe symptoms should be handled through 911.

Symptoms

Symptoms depend on the amount of carbon monoxide, how long the exposure lasts, and the person's health. They may develop gradually during a low-level exposure or appear quickly when CO levels are high.

Early or milder symptoms can include:

With more serious poisoning, a person may become confused, behave unusually, have difficulty walking, faint, or have a seizure. Severe exposure can cause an abnormal heart rhythm, heart injury, coma, or death.

Symptoms may improve after a person leaves the affected area. That improvement does not prove the exposure was harmless. Carbon monoxide leaves the blood over time, especially after oxygen treatment, but injury to the brain or heart may still have occurred.

Seek emergency care immediately after suspected CO exposure if there is fainting, confusion, severe headache, chest pain, shortness of breath, weakness on one side, trouble speaking, a seizure, or difficulty waking the person. Pregnant people, infants, older adults, and people with heart, lung, or blood disorders should also receive prompt medical assessment because serious effects can occur at lower exposures.

- Headache, dizziness, weakness, or unusual tiredness
- Nausea, vomiting, or stomach discomfort
- Trouble concentrating or feeling mentally "foggy"
- Shortness of breath or chest discomfort
- Blurred vision or poor coordination

Causes and risk factors

Any device that burns gasoline, natural gas, propane, kerosene, oil, wood, or charcoal can produce carbon monoxide. Problems arise when combustion is incomplete or fumes cannot escape.

Frequent sources include poorly maintained furnaces, boilers, water heaters, fireplaces, wood stoves, and portable fuel-burning heaters. Blocked chimneys or vents may send exhaust back into a building. Storm damage, snow, debris, or animal nests can obstruct ventilation.

Portable generators are a major risk when operated inside a home, garage, basement, shed, or near doors and windows. Opening a window or garage door does not make indoor generator use safe. Charcoal grills, camp stoves, and gasoline-powered tools can also create dangerous CO levels in enclosed or partly enclosed spaces.

Vehicle exhaust may build up when an engine runs in a garage, even if the garage door is open. Exhaust can also enter a vehicle because of a damaged exhaust system or when snow blocks the tailpipe. Fires can produce large amounts of carbon monoxide along with other toxic gases.

Risk is higher during power outages and cold weather, when people may use unfamiliar heating or cooking equipment. Sleeping people may not notice symptoms before becoming seriously ill. Alcohol, sedating medicines, or recreational drugs may further reduce awareness.

Some people are more vulnerable to injury. A fetus receives carbon monoxide through the placenta and clears it more slowly than the pregnant person. Infants, older adults, and people with anemia or heart, lung, or neurologic disease may also tolerate reduced oxygen delivery poorly.

Routine prevention includes installing working CO alarms near sleeping areas and on each level of the home, following local placement requirements, and testing them regularly. Fuel-burning appliances, vents, and chimneys should be maintained by qualified professionals. A CO alarm is an added safeguard, not a replacement for safe equipment and ventilation.

Diagnosis

Diagnosis begins with the circumstances of the exposure and the person's symptoms. Clinicians may ask where the person was, which fuel-burning equipment was operating, whether a CO alarm sounded, and whether other people or pets became ill.

A blood test can measure carboxyhemoglobin, which forms when carbon monoxide attaches to hemoglobin. The sample may be taken from a vein or artery and analyzed with a device called a co-oximeter.

The result must be interpreted carefully. Carboxyhemoglobin levels fall after a person reaches fresh air and fall faster when oxygen is given. A low measurement taken later does not always

rule out an earlier exposure. People who smoke may have higher usual levels than nonsmokers. The measured level also does not reliably predict how severe the symptoms or later complications will be.

A standard fingertip pulse oximeter may appear normal because most devices cannot distinguish carboxyhemoglobin from hemoglobin carrying oxygen. A routine arterial oxygen measurement can also be misleading. Clinicians therefore consider the exposure history, symptoms, examination, and co-oximetry together.

Additional testing depends on the situation. An electrocardiogram, or ECG, and blood tests may look for heart stress or injury. Neurologic testing checks memory, attention, balance, strength, and coordination. Chest imaging or other studies may be needed after smoke inhalation, breathing problems, trauma, or loss of consciousness. Pregnancy testing may affect monitoring and treatment decisions.

Treatment and management

The first step is to stop the exposure. Move into fresh air without delaying to ventilate the building or turn off equipment. Emergency responders can test the environment and enter with protective equipment.

In medical care, treatment usually begins with high-concentration oxygen delivered through a close-fitting mask. Oxygen helps remove carbon monoxide from hemoglobin and improves oxygen delivery to tissues. People who cannot protect their airway or breathe adequately may need a breathing tube and mechanical ventilation.

Clinicians also monitor heart rhythm, blood pressure, breathing, mental status, and other signs of organ injury. Seizures, low blood pressure, abnormal heart rhythms, burns, trauma, and other problems are treated as needed. Smoke exposure may require assessment for additional toxic substances because carbon monoxide may not be the only hazard.

Some patients are considered for hyperbaric oxygen therapy. This treatment delivers oxygen under increased pressure inside a special chamber. It removes carbon monoxide more quickly and may help protect injured tissue. Transfer to a hyperbaric center may be discussed after loss of consciousness, significant neurologic symptoms, severe heart effects, marked acid buildup in the blood, or other evidence of serious poisoning.

The evidence comparing hyperbaric oxygen with standard high-concentration oxygen is not conclusive for every patient. Decisions are based on the overall clinical picture rather than one blood level alone. Availability, time since exposure, transportation risks, and specialist advice also matter.

Pregnancy deserves special attention because fetal exposure may be more severe or last longer than the pregnant person's symptoms suggest. Emergency and poison specialists may recommend extended oxygen treatment or consultation with a hyperbaric center.

A building linked to exposure should not be entered again until the fire department, utility company, or another qualified professional has confirmed that it is safe. The source needs to be identified and repaired or removed before fuel-burning equipment is used again.

Complications

Many people recover after prompt removal from the source and oxygen treatment. However, serious exposure may injure the brain, heart, or other organs.

Neurologic effects can include problems with memory, attention, mood, balance, movement, or sleep. Some begin during the initial illness. Others appear after an apparent recovery, sometimes days or weeks later. These are often called delayed neurologic effects.

Heart complications may include heart muscle injury, chest pain, abnormal rhythms, or worsening of existing heart disease. A person does not need to have obvious chest pain for heart injury to occur, which is why clinicians may order an ECG and blood testing after a significant exposure.

Severe poisoning can cause lasting disability, particularly after coma, seizures, cardiac arrest, or prolonged exposure. Pregnancy complications may occur because the fetus is especially sensitive to reduced oxygen delivery.

Possible delayed changes should be taken seriously without assuming that every headache or memory lapse is caused by carbon monoxide. A medical evaluation can look for other explanations and decide whether neurologic, cardiac, or rehabilitation testing is appropriate.

Follow up

Follow-up needs depend on the exposure, symptoms, examination, and test results. After emergency treatment, follow the discharge plan and attend any recommended visits with primary care, cardiology, neurology, obstetrics, occupational medicine, or another specialist.

During recovery, watch for new or worsening difficulty with memory, concentration, mood, walking, coordination, vision, sleep, or daily tasks. Report these changes promptly, especially if they appear after a symptom-free period. Persistent chest discomfort, unusual shortness of breath, palpitations, or reduced ability to exercise also needs medical review.

Call emergency services for fainting, a seizure, severe confusion, new weakness, trouble speaking, chest pain, major breathing difficulty, or inability to wake the person. These are not routine follow-up concerns.

Before returning to the affected home, workplace, vehicle, or recreational space, confirm that the source has been corrected. Replace or service alarms and appliances as directed by qualified professionals. If the exposure occurred at work, an occupational health evaluation may help identify hazards and reduce repeat exposure.

Sources

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