CONDITION

Antifreeze poisoning

Learn how antifreeze poisoning happens, why symptoms may be delayed, how it is diagnosed and treated, and when to seek emergency help.

WHAT IT IS
Poisoning from harmful antifreeze chemical exposure

BODY SYSTEM
Kidneys, brain, heart and lungs

MAIN SYMPTOMS
Nausea or vomiting, confusion, rapid breathing, reduced urination

WHAT CAUSES IT
Toxic chemical exposure, usually swallowed engine coolant

HOW IT IS DIAGNOSED
Blood ethylene glycol measurement

MAIN TREATMENT
Hospital antidote therapy, supportive care, sometimes dialysis

CAN IT BE CURED?
Sometimes - prompt treatment allows full recovery

IS IT AN EMERGENCY?
Yes - any suspected swallowing needs immediate care

LONG-TERM OUTLOOK
Full recovery possible, but lasting kidney impairment may occur

Overview

Antifreeze poisoning happens when someone is exposed to a harmful amount of an antifreeze chemical. Most serious cases involve swallowing engine coolant that contains ethylene glycol . This chemical may taste sweet, although some products contain a bittering agent.

The body changes ethylene glycol into toxic acids and crystals. These substances can make the blood dangerously acidic and damage the kidneys, brain, heart, and lungs. A person may appear only mildly intoxicated at first, even while toxic substances are forming inside the body.

Some antifreeze products use propylene glycol , which is generally less toxic than ethylene glycol. However, the ingredients and concentrations vary. Other automotive fluids, including some windshield-washer fluids, may contain methanol , which causes a different form of toxic alcohol poisoning. The product label alone may not provide enough information to judge the

risk safely.

Any suspected swallowing of antifreeze needs immediate expert advice, even if the person feels well. In the United States, call Poison Help at 1-800-222-1222 . Call emergency services if the person is unconscious, having a seizure, having trouble breathing, or cannot be awakened. Outside the United States, contact the local poison center or emergency service.

Do not wait for symptoms, make the person vomit, or give alcohol or another home treatment. Early hospital treatment can prevent the body from producing more toxic breakdown products.

Symptoms

Symptoms depend on the chemical, amount, time since exposure, and whether alcohol or other substances were also used. Ethylene glycol poisoning can develop in stages, but not everyone follows the same pattern.

Early symptoms may resemble alcohol intoxication. They can include:

More serious effects may develop as the body produces toxic acids. These can include a fast heart rate, low blood pressure, worsening confusion, seizures, or coma. Breathing may become deep and rapid as the body tries to correct excess acid in the blood.

Kidney injury often becomes apparent later. Possible signs include pain in the side or lower back, reduced urination, swelling, nausea, or unusual tiredness. A person may temporarily seem better before kidney problems become clear.

Low blood calcium can occur because toxic ethylene glycol products bind with calcium. Severe calcium changes may contribute to muscle spasms, an abnormal heart rhythm, or seizures.

Symptoms alone cannot confirm or exclude antifreeze poisoning. Drinking ordinary alcohol at the same time may delay the appearance of toxic effects because both substances are processed by the same liver enzyme. This delay does not make the exposure safe.

Seek emergency care immediately after a known or possible ingestion. Emergency symptoms include difficulty breathing, severe confusion, collapse, seizure, loss of consciousness, or inability to wake the person.

Skin contact is less likely to cause whole-body poisoning because ethylene glycol is not absorbed well through intact skin. Remove contaminated clothing and rinse the skin with water. For an eye splash, rinse the eye with clean lukewarm water and contact a poison center for instructions. Breathing large amounts of mist may require medical assessment, especially if coughing, breathing difficulty, or dizziness occurs.

- Nausea, vomiting, or stomach pain
- Dizziness, headache, or slurred speech
- Poor coordination or unsteady walking
- Drowsiness, confusion, or unusual behavior
- Rapid breathing

Causes and risk factors

Antifreeze poisoning most often follows swallowing engine coolant. Exposure may be accidental, intentional, or related to unsafe storage.

Common situations include:

The severity depends on the specific ingredient, its concentration, the amount swallowed, and how quickly treatment begins. Because containers may hold diluted or concentrated fluid, the volume alone does not reliably show how much ethylene glycol was taken.

Young children may be at risk from small exploratory sips. Adults may have more severe exposure when a larger amount is swallowed or care is delayed. Existing kidney disease may complicate the illness and recovery, but serious poisoning can also occur in someone without prior health problems.

Antifreeze should remain in its original, clearly labeled container with the cap secured. It should never be placed in a food or beverage container. Spills should be cleaned promptly and stored products kept away from children and animals.

- Antifreeze stored in an unmarked bottle, cup, or drink container
- A spill left where a child can reach it
- Confusing automotive fluids with another liquid
- Exposure while transferring, repairing, or disposing of coolant
- Intentional ingestion during a mental health crisis
- Use of improperly produced or contaminated alcohol

Diagnosis

Clinicians diagnose antifreeze poisoning using the exposure history, physical examination, blood and urine tests, and sometimes direct measurement of ethylene glycol. Treatment may

begin before a confirmatory result is available because delaying an antidote can allow more toxic acids to form.

If possible, bring the product container or a clear photograph of its label to the hospital. Important information includes the product name, ingredients, estimated amount, time of exposure, symptoms, and whether alcohol, medicines, or other chemicals were involved. Do not delay emergency care to search for this information.

Blood tests may assess:

Clinicians may calculate the anion gap , which can rise when toxic acids build up. They may also calculate the osmolal gap , which can be elevated earlier while unchanged ethylene glycol remains in the blood. Neither test is perfect. A normal result, especially at one point in time, does not always rule out poisoning.

Urine may be examined for calcium oxalate crystals, which can form from ethylene glycol breakdown products. These crystals can support the diagnosis, but they may be absent and can occur for other reasons.

An electrocardiogram may be used to check heart rhythm. People with significant symptoms may need repeated blood tests, close monitoring, and measurement of urine output. Imaging is not usually the main way to diagnose the poisoning, although it may be needed to investigate complications or another possible cause of symptoms.

- Acid levels and the blood's chemical balance
- Kidney function
- Calcium, potassium, and other electrolytes
- Glucose and liver-related measurements
- Ethylene glycol and other toxic alcohol levels, when available

Treatment and management

Antifreeze poisoning is treated in a hospital. Management depends on the chemical involved, the estimated exposure, symptoms, laboratory findings, and time since ingestion. A poison specialist or medical toxicologist may help guide care.

The preferred antidote for ethylene glycol poisoning is usually fomepizole . It blocks alcohol dehydrogenase, the liver enzyme that changes ethylene glycol into its more harmful products. Fomepizole does not remove toxic acids that have already formed, so early treatment matters.

Ethanol also blocks this enzyme and may be used in some settings when fomepizole is

unavailable. It requires careful hospital monitoring because it can cause intoxication, low blood sugar, and other problems. A person should never drink alcohol as a home treatment.

Other treatment may include:

Some patients need hemodialysis , a procedure in which a machine filters the blood. Hemodialysis can remove ethylene glycol and its toxic products while correcting severe blood acidity and electrolyte problems. It may be considered for severe poisoning, significant kidney injury, serious clinical symptoms, or certain laboratory findings. The decision is individualized and may follow toxicology and kidney-specialist recommendations.

When dialysis is used, antidote treatment may need adjustment because dialysis can also remove fomepizole. This is managed by the treating team rather than by the patient.

Clinicians sometimes provide vitamins such as thiamine and pyridoxine to support less harmful metabolic pathways. These do not replace an antidote, monitoring, or dialysis when those treatments are needed.

Activated charcoal, which is used for some poisonings, does not bind ethylene glycol well and is not routinely useful for an isolated antifreeze ingestion. Making someone vomit can cause choking or aspiration and should not be attempted.

- Intravenous fluids and supportive care
- Sodium bicarbonate to help correct severe acid buildup
- Treatment for abnormal calcium or other electrolyte levels
- Medicines for seizures or other complications
- Monitoring of breathing, heart rhythm, blood pressure, and urine output

Complications

Without timely treatment, ethylene glycol poisoning can cause severe metabolic acidosis , meaning the blood becomes dangerously acidic. This can interfere with the heart, brain, breathing, and circulation.

Other possible complications include:

Some people recover fully after prompt treatment. Kidney function may take days or weeks to improve, and a smaller number of people may have lasting kidney impairment. Delayed nervous-system problems, including weakness or problems involving certain cranial nerves, have been reported but are uncommon.

The risk of complications depends on the substance, amount, delay before treatment, and

degree of acid buildup or organ injury.

- Acute kidney injury, sometimes requiring temporary dialysis
- Low blood calcium and related heart-rhythm or muscle problems
- Seizures, coma, or brain swelling
- Low blood pressure and shock
- Fluid buildup in the lungs or respiratory failure
- Injury to multiple organs

Follow up

After hospital treatment, follow-up usually focuses on kidney recovery and any remaining symptoms. The care team may repeat blood tests to check kidney function, electrolytes, and the body's acid balance. People who required dialysis may need continued assessment by a kidney specialist until kidney function is stable.

Seek prompt medical advice after discharge for decreasing urination, worsening swelling, repeated vomiting, new weakness, increasing confusion, or a return of breathing problems. Call emergency services for a seizure, collapse, severe breathing difficulty, or inability to wake the person.

Routine follow-up may include reviewing medicines, hydration instructions, activity limits, and the timing of laboratory testing. Follow the discharge plan rather than using supplements or changing fluid intake without medical guidance, especially if kidney function has been affected.

If the exposure was intentional, compassionate mental health care is an important part of follow-up. This may include a safety plan, crisis support, counseling, or treatment for depression, substance use, or another contributing condition. An intentional poisoning is a medical emergency, not a personal failure.

Families can also reduce future risk by checking how automotive chemicals are stored, keeping them in original containers, securing caps, and disposing of unwanted products through an appropriate hazardous-waste program.

Sources

- Agency for Toxic Substances and Disease Registry. Medical Management Guidelines for Ethylene Glycol .

- MedlinePlus Medical Encyclopedia. Antifreeze poisoning . U.S. National Library of Medicine.
- DailyMed. Antizol-fomepizole injection, solution: prescribing information . U.S. National Library of Medicine.
- Ghannoum M, et al. Extracorporeal treatment for ethylene glycol poisoning: systematic review and recommendations from the EXTRIP workgroup. Critical Care . 2023;27:56.
- Caravati EM, et al. Ethylene glycol exposure: an evidence-based consensus guideline for out-of-hospital management. Clinical Toxicology . 2005;43(5):327-345.
- Kraut JA, Mullins ME. Toxic alcohols. The New England Journal of Medicine . 2018;378:270-280.