CONDITION

Methanol poisoning

Methanol poisoning is toxic injury caused when the body breaks methanol down into harmful acids.

WHAT IT IS
Toxic injury from methanol and its breakdown products

BODY SYSTEM
Eyes, brain, blood chemistry, and multiple organs

MAIN SYMPTOMS
Nausea, headache, blurred vision, fast breathing

WHAT CAUSES IT
Swallowing, inhaling, or absorbing toxic methanol

HOW IT IS DIAGNOSED
Blood methanol level and acid-base blood tests

MAIN TREATMENT
Antidote, supportive care, and sometimes hemodialysis

CAN IT BE CURED?
Sometimes - prompt treatment can prevent lasting injury

IS IT AN EMERGENCY?
Yes - any suspected exposure needs immediate assessment

LONG-TERM OUTLOOK
Often good after early treatment; severe poisoning can cause disability

Overview

Methanol is a type of alcohol used in products such as solvents, fuels, windshield-washer fluids, and some industrial chemicals. It is different from ethanol, the alcohol found in regulated alcoholic drinks.

Methanol itself can affect the brain, but most serious harm happens after the liver breaks it down. This process produces formic acid and related chemicals. They can make the blood dangerously acidic and interfere with how cells use oxygen.

The optic nerves, which carry visual information from the eyes to the brain, are especially sensitive. Severe poisoning can also injure the brain and other organs.

Methanol poisoning may follow swallowing a methanol-containing product or drinking

contaminated or illegally produced alcohol. Significant exposure through breathing or skin contact is less common, but it can happen in poorly ventilated workplaces or after prolonged contact.

Symptoms may not begin for several hours. A person can appear well while toxic breakdown products are building up. For this reason, suspected exposure needs emergency assessment even when there are no symptoms.

Symptoms

Early symptoms can resemble alcohol intoxication or a stomach illness. They may include:

Visual symptoms are an important warning sign. Some people describe looking through fog, seeing flashing lights, or having a dark area in their vision. Vision can worsen as poisoning progresses.

A buildup of acid in the blood, called metabolic acidosis, may cause rapid breathing, low blood pressure, worsening confusion, or loss of consciousness. Severe poisoning can lead to seizures, coma, or cardiac arrest.

Symptoms are often delayed because methanol must first be converted into its more toxic breakdown products. The delay may be longer if ethanol was also consumed because ethanol temporarily slows methanol breakdown. This does not make the exposure safe.

- Headache, dizziness, weakness, or unusual tiredness
- Nausea, vomiting, or abdominal pain
- Poor coordination, confusion, or drowsiness
- Blurred, dim, or "snowy" vision
- Sensitivity to light or pain with bright light
- Fast, deep breathing

Causes and risk factors

Methanol poisoning most often happens after methanol is swallowed. Possible sources include:

Methanol cannot be identified reliably by its appearance, smell, or taste. A drink containing dangerous methanol may look normal.

Work involving methanol can create a risk through spills, skin contact, or concentrated vapour.

Risk is greater in enclosed or poorly ventilated spaces and when protective equipment is not used correctly.

Young children may swallow methanol-containing products accidentally. Adults may also drink them intentionally or because the container has been mistaken for a beverage.

- Illegally produced or counterfeit alcoholic drinks
- Alcohol contaminated during unsafe production
- Windshield-washer fluid, solvents, fuels, or paint products
- Products incorrectly stored in drink bottles
- Industrial or laboratory chemicals
- Contaminated alcohol-based products

Diagnosis

Emergency clinicians consider the circumstances of exposure, symptoms, and blood test results. If possible, information about the product, amount, and time of exposure can help, but treatment does not always wait for every detail.

A laboratory measurement of methanol in the blood can confirm exposure. However, this test may not be available quickly in every hospital.

Other tests look for the effects of methanol poisoning. These commonly include blood gases and electrolyte levels to measure acidity. Clinicians may calculate an "anion gap," which helps detect unmeasured acids in the blood, and an "osmolar gap," which can suggest toxic alcohol in the bloodstream.

Neither calculation can safely rule out poisoning by itself. The osmolar gap may be raised early and return toward normal as methanol is converted into formic acid. At that stage, the anion gap and blood acidity may become more abnormal.

Additional testing may include kidney and liver function, blood glucose, an ethanol level, an electrocardiogram, and tests for other toxic alcohols. An eye examination may assess vision, the retina, and the optic nerves. Brain imaging is sometimes needed when there are severe or persistent neurological symptoms.

Treatment and management

Methanol poisoning is treated in hospital. Care may begin before a confirmatory methanol

result returns when the exposure, symptoms, or blood tests strongly suggest poisoning.

The main antidote is fomepizole. It blocks the enzyme that converts methanol into its harmful breakdown products. Ethanol can also block this process and may be used as a medical antidote in some settings. Both require careful hospital monitoring.

Drinking alcohol at home is not a safe treatment. It can delay emergency care, cause additional poisoning, and make medical management more difficult.

Hemodialysis may be needed in serious cases. During dialysis, blood passes through a machine that removes methanol and formate. It also helps correct severe blood acidity. The decision is based on the overall situation, including symptoms, laboratory findings, organ injury, and access to testing.

Other treatments may include:

Repeated blood tests are used to follow methanol levels, acidity, and organ function. Treatment continues until the toxic alcohol has been cleared and the blood chemistry is stable.

Do not induce vomiting after a possible exposure. Vomiting does not reliably remove the methanol and can cause choking, especially if the person becomes drowsy.

- Sodium bicarbonate to correct dangerous blood acidity
- Folinic acid or folic acid to help the body process formate
- Oxygen, intravenous fluids, and support for blood pressure
- Medicines for seizures
- Breathing support if consciousness or breathing worsens

Complications

The main complications come from severe blood acidity and injury to the optic nerves or brain.

Optic nerve damage can cause reduced sharpness of vision, problems seeing colours, blind areas, or complete sight loss. Some visual problems improve after treatment, while others are permanent.

Brain injury may affect movement, balance, memory, thinking, or behaviour. Damage to areas that control movement can sometimes cause stiffness, tremor, slowed movement, or symptoms resembling Parkinson's disease. Some neurological effects become clearer days or weeks after the immediate poisoning.

Other possible complications include seizures, low blood pressure, abnormal heart rhythms, coma, and failure of several organs. Severe untreated poisoning can be fatal.

The likelihood of lasting harm is influenced by how much toxic metabolite formed, the degree of blood acidity, whether vision or consciousness was affected, and how quickly effective treatment began.

Prevention

Many methanol exposures can be prevented.

Do not drink alcohol from an uncertain, unregulated, or counterfeit source. Methanol contamination cannot be ruled out by smelling, tasting, or looking at a drink.

Keep methanol-containing products in their original, clearly labelled containers. Never transfer windshield fluid, solvent, fuel, or industrial alcohol into a bottle used for water, soft drinks, or food.

Store these products where children and other vulnerable people cannot reach them. Follow label instructions for ventilation, gloves, eye protection, and safe disposal.

At work, use the ventilation and protective equipment required for the task. Report leaking containers, spills, or strong vapour exposure promptly. Clothing soaked with methanol should be removed safely, and affected skin should be washed with running water.

Product recalls should be taken seriously, including recalls of contaminated alcohol-based hand products. Stop using a recalled product and follow the disposal instructions from the relevant public health or regulatory authority.

Living with it and what to expect

Methanol poisoning is an acute event rather than an ongoing condition. The immediate phase may involve several days in hospital, depending on the exposure, blood acidity, need for dialysis, and effects on vision or the brain.

People treated before serious injury develops may recover without lasting problems. Recovery is less predictable when there has been severe acidosis, loss of consciousness, visual injury, or brain damage.

Vision may improve over days or weeks, but some changes can persist. Follow-up with an eye specialist may include vision testing, colour testing, examination of the optic nerves, and scans that measure nerve tissue at the back of the eye.

Neurological symptoms can also improve gradually, remain stable, or occasionally emerge after the hospital stay. Rehabilitation may include physical therapy, occupational therapy,

speech therapy, or support for reduced vision.

Routine follow-up after discharge is different from emergency care. Scheduled appointments may monitor eyesight, movement, memory, mood, and the return to work or usual activities. New vision loss, severe confusion, seizures, or reduced consciousness require urgent reassessment rather than waiting for a routine appointment.

When to get medical help

Any suspected methanol exposure is an emergency. Contact local emergency services or a poison centre immediately, even if the person feels well. Do not wait for symptoms to appear.

Get emergency help immediately after possible exposure if there is:

Move away from methanol vapour into fresh air if this can be done safely. After skin exposure, remove contaminated clothing and rinse the skin with running water. After eye exposure, begin rinsing with clean running water. Emergency or poison-centre advice is still needed.

Do not induce vomiting or give alcohol, food, medicines, or home remedies unless a poison specialist or emergency clinician specifically directs this. If safe, bring the product container or a photograph of its label for identification.

After hospital treatment, attend planned follow-up. Contact the treating service promptly about worsening vision, new movement difficulties, persistent headaches, memory changes, or problems managing daily activities.

- Blurred, dim, snowy, or lost vision
- Fast or unusually deep breathing
- Repeated vomiting or severe abdominal pain
- Confusion, unusual behaviour, or increasing drowsiness
- A seizure, collapse, or loss of consciousness

Common questions

How long does methanol poisoning take to show symptoms?

Symptoms may take several hours to appear because the liver must convert methanol into toxic acids. The delay can be longer when ethanol was also consumed. A symptom-free period does not rule out serious poisoning.

Can methanol poisoning be cured?

Prompt antidote treatment can stop more toxic breakdown products from forming, and dialysis can remove methanol and formate. Some people recover fully. Established injury to the optic nerves or brain may not be completely reversible.

Can I tell whether alcohol contains methanol by its smell or taste?

No. Dangerous contamination may not cause an obvious change in appearance, smell, or taste. Alcohol from an uncertain or unregulated source should not be tested by drinking it.

Does ordinary alcohol treat methanol poisoning?

Medical ethanol can block methanol breakdown, but it must be given and monitored in a controlled healthcare setting. Drinking alcohol at home is unsafe and must not delay emergency treatment.

Can eyesight return after methanol poisoning?

Some visual loss improves after treatment, particularly when care begins early. Other damage can be permanent. An eye specialist can assess the optic nerves and monitor recovery over time.

Can methanol be absorbed through the skin or inhaled?

Yes. Serious poisoning is most often linked to swallowing methanol, but prolonged skin exposure or breathing concentrated vapour can also be harmful. This is more likely in enclosed spaces or after a large industrial spill.

Sources

- Barceloux DG, Bond GR, Krenzelok EP, Cooper H, Vale JA. "American Academy of Clinical Toxicology practice guidelines on the treatment of methanol poisoning." Journal of Toxicology: Clinical Toxicology . 2002;40(4):415-446.
- Kraut JA, Mullins ME. "Toxic Alcohols." New England Journal of Medicine . 2018;378(3):270-280.
- McMartin K, Jacobsen D, Hovda KE. "Antidotes for poisoning by alcohols that form toxic metabolites." British Journal of Clinical Pharmacology . 2016;81(3):505-515.
- Roberts DM, Yates C, Megarbane B, et al. "Extracorporeal treatment for methanol poisoning: systematic review and recommendations from the EXTRIP Workgroup." Critical Care Medicine . 2015;43(2):461-472.



- US Centers for Disease Control and Prevention, National Institute for Occupational Safety and Health. "Methanol: Systemic Agent." Emergency Response Safety and Health Database .