CONDITION

# Acetaminophen overdose

Learn how acetaminophen overdose affects the liver, why early symptoms can be mild, and how prompt testing and antidote treatment can prevent serious harm.

**WHAT IT IS**
Poisoning from excess acetaminophen

**BODY SYSTEM**
Digestive

**MAIN SYMPTOMS**
Nausea or vomiting, abdominal pain, tiredness, jaundice

**WHAT CAUSES IT**
Excess acetaminophen intake

**HOW IT IS DIAGNOSED**
Blood acetaminophen level and liver tests

**MAIN TREATMENT**
Antidote treatment and supportive care

**CAN IT BE CURED?**
Sometimes, early treatment enables full recovery

**IS IT AN EMERGENCY?**
Yes, any possible overdose

**LONG-TERM OUTLOOK**
Full recovery common with early treatment, death possible in severe poisoning

## Overview

Acetaminophen overdose happens when someone takes more acetaminophen than the body can safely process. Acetaminophen, also called paracetamol in some countries, is a common medicine for pain and fever. It is found in many prescription and over-the-counter products.

Most acetaminophen is broken down safely by the liver. A small amount becomes a toxic substance. The liver usually neutralizes this substance with a protective chemical called glutathione. During an overdose, glutathione can run low. The toxic substance can then injure liver cells.

An overdose may follow one large dose or repeated doses over hours or days. It can be accidental, such as taking several cold, flu, sleep, or pain products that contain acetaminophen. It may also be intentional.

Early treatment is important because serious liver injury can develop before a person feels very ill. The antidote, acetylcysteine, can greatly reduce the risk of liver damage when it is started promptly. It may still help after liver injury has begun.

A possible acetaminophen overdose requires immediate professional advice. In the United States, call Poison Help at 1-800-222-1222 . Do not wait for symptoms. Outside the United States, contact your local poison center or emergency service. Call emergency services now if the person is unconscious, having trouble breathing, having a seizure, or cannot be awakened.

## Symptoms

A person may have no symptoms during the first several hours after an acetaminophen overdose. Feeling well does not mean the dose was safe.

Early symptoms, when present, may include:

Over the next one to three days, liver injury may become clearer. Symptoms can include pain or tenderness in the upper-right abdomen, continued vomiting, weakness, or reduced appetite. Blood tests may show liver injury even when symptoms remain mild.

Severe poisoning can cause acute liver failure, meaning the liver suddenly cannot perform its normal functions. Possible signs include:

These later symptoms are an emergency. However, treatment should begin based on the possible exposure and test results rather than waiting for them to appear.

Symptoms and timing vary. Repeated excessive doses may cause a less predictable illness than one overdose taken at a known time. Other medicines taken at the same time can also change how quickly acetaminophen is absorbed.

- Nausea or vomiting
- Loss of appetite
- Sweating
- Tiredness
- Pale appearance
- General discomfort or abdominal pain
- Yellow skin or eyes, called jaundice
- Confusion, unusual sleepiness, or behavior changes
- Easy bruising or bleeding

- Swelling of the abdomen
- Very low urine output
- Low blood sugar
- Rapid breathing, severe weakness, or collapse

## Causes and risk factors

A single overdose may occur when someone misreads a label, confuses tablet strengths, or takes more medicine because pain or fever has not improved. Children may swallow medicine they find, although many serious overdoses involve adolescents or adults.

Repeated overdose can happen when doses are taken too close together or when a person continues taking excessive amounts over several days. It may be harder to recognize because there is no single clear time of ingestion.

Acetaminophen is included in many combination products. Examples include some medicines for colds, flu, allergies, migraine, sleep, and prescription pain relief. Labels may use the name "acetaminophen" or an abbreviation such as "APAP." Taking more than one acetaminophen-containing product increases the chance of an accidental overdose.

Factors that may affect the risk or severity of injury include:

These factors do not reliably show whether liver injury will occur. A blood level that is used to assess one large, recent ingestion cannot be interpreted in the same way for repeated dosing, an unknown ingestion time, or a delayed presentation.

Any possible overdose deserves poison-center or medical assessment. Do not try to calculate the risk at home or wait to see whether symptoms develop.

- The total amount taken and the time over which it was taken
- Delay in receiving medical care
- Prolonged fasting, poor nutrition, or severe illness
- Regular heavy alcohol use
- Existing liver disease
- Medicines that affect how the liver processes drugs
- A very large overdose or an overdose involving other substances

## Diagnosis

Clinicians first ask what product was taken, how much may have been taken, and when it happened. They also ask about repeated doses, other medicines, alcohol use, medical conditions, symptoms, and whether the exposure was accidental or intentional.

Bring the medicine package, if available. Product strength and ingredients are important because combination products may contain substances other than acetaminophen. Do not delay emergency care to search for packaging.

A blood test measures the acetaminophen concentration. After one immediate-release ingestion at a known time, clinicians may compare a level taken at least four hours after ingestion with the Rumack-Matthew nomogram. This chart estimates the risk of liver injury and helps guide antidote treatment.

The nomogram does not apply when the ingestion time is unknown, when excessive doses were repeated, or when the person already has signs of liver injury. Extended-release products and medicines that slow stomach emptying may require additional levels.

Other blood tests may include:

Clinicians may repeat these tests to see whether treatment is working. In severe poisoning, mental status, blood pressure, urine output, blood sugar, and signs of liver failure are monitored closely.

A low or undetectable acetaminophen level does not always rule out poisoning. The medicine may already have left the bloodstream by the time liver injury is discovered. The history and liver test results remain important.

- Alanine aminotransferase and aspartate aminotransferase, which rise when liver cells are injured
- International normalized ratio, or INR, which shows how well the blood is clotting
- Bilirubin, glucose, electrolytes, and kidney function tests
- Blood acidity and lactate in severe cases
- Tests for other substances when a mixed overdose is possible

## Treatment and management

Do not induce vomiting or use a home remedy. Call a poison center or seek emergency care immediately. Poison specialists can advise whether evaluation in an emergency department is needed.

Acetylcysteine, also called N-acetylcysteine or NAC, is the main antidote. It restores the liver's ability to neutralize the toxic breakdown product. It also has benefits after liver injury has started.

NAC may be given by mouth or through a vein. The route and length of treatment depend on the situation, local protocols, laboratory results, and the person's ability to take medicine. Treatment is often started before all results are available when the history suggests a potentially harmful overdose and waiting could cause a meaningful delay.

Clinicians do not stop NAC based only on the completion of a standard treatment period. They also consider the acetaminophen level, liver tests, clotting results, and the person's overall condition. Treatment may continue when acetaminophen remains detectable or liver injury is worsening.

Intravenous NAC can sometimes cause flushing, itching, rash, wheezing, or low blood pressure. Medical teams can manage these reactions and decide how to continue the antidote. Serious reactions are uncommon, and NAC should not be avoided when it is needed.

Activated charcoal may be used in selected recent overdoses. It binds medicine in the digestive tract and reduces absorption. It is not appropriate for everyone, especially when a person cannot protect their airway. It should only be given under professional direction.

Supportive care may include fluids, nausea treatment, correction of low blood sugar or electrolyte problems, and close monitoring. Kidney problems, abnormal blood clotting, or brain effects from liver failure may require intensive care.

A very large overdose can occasionally cause severe metabolic problems before typical liver injury develops. Rarely, hemodialysis may be used to remove acetaminophen from the blood. A medical toxicologist or poison center should help guide these complex cases.

People with signs of acute liver failure may need care at a liver transplant center. Early transfer allows the transplant team to assess the person while other treatment continues. Only a small portion of patients require transplantation, particularly when NAC is given promptly.

To help prevent another accidental overdose, check the active-ingredient section of every medicine label. Avoid using two acetaminophen-containing products unless a clinician or pharmacist has confirmed the plan. Use the measuring device supplied with a liquid product, and keep medicines in child-resistant containers away from children.

## Complications

The main complication is acute liver injury. Mild injury may be visible only on blood tests and can resolve with treatment. More extensive injury can interfere with blood clotting, blood sugar

control, and the removal of waste products.

Acute liver failure may lead to confusion or reduced consciousness because toxins affect the brain. This is called hepatic encephalopathy. It can also cause bleeding, infection, dangerously low blood sugar, acid buildup, and failure of other organs.

Kidney injury can occur with or without severe liver failure. Some people need temporary support for kidney function. Rarely, severe poisoning can cause death or require liver transplantation.

Many people recover fully, especially when treatment begins early. The liver can repair substantial damage. Recovery time depends on the amount taken, how quickly NAC was started, laboratory trends, and whether complications developed.

## Follow up

Follow-up depends on the severity of the exposure. Some people can leave care after acetaminophen is no longer detectable, relevant laboratory results are reassuring, and the treating team determines that antidote therapy is no longer needed. Others require repeated blood tests or hospital monitoring until liver function is clearly improving.

After discharge, follow the care team's instructions about repeat liver tests and the use of acetaminophen, alcohol, supplements, and other medicines. Do not restart acetaminophen after an overdose unless a clinician says it is safe.

Contact the treating clinician promptly if nausea, abdominal pain, poor appetite, or unusual tiredness returns. Seek urgent medical assessment for yellow skin or eyes, reduced urination, worsening vomiting, or new bruising.

Call emergency services for confusion, inability to stay awake, a seizure, trouble breathing, collapse, or significant bleeding.

If the overdose was intentional or occurred during a period of emotional distress, a mental health and safety assessment is an important part of care. Follow-up may include counseling, crisis support, medication review, and a plan for safer medicine storage. If there is an immediate risk of self-harm, call emergency services or a local crisis service rather than leaving the person alone.

## Sources

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