HEALTH BASICS

Liquid nitrogen

Liquid nitrogen is an extremely cold liquid used to freeze tissue and preserve materials.

WHAT IT IS
Extremely cold liquid form of nitrogen gas

WHERE IT COMES UP
Skin procedures, laboratories, workplaces, and novelty foods

WHY IT MATTERS
Freezes tissue and can displace breathable oxygen

WHAT IT IS NOT
Not a disease or diagnosis

WHO TO ASK
Treating clinician, poison centre, or workplace safety service

HOW IT IS CHECKED
No routine health test

Overview

Liquid nitrogen is nitrogen gas cooled until it becomes a liquid. At normal air pressure, it boils at about −196°C (−321°F). It is colourless and has no smell.

This is a substance, not a disease or diagnosis. In healthcare, liquid nitrogen is best known for cryotherapy, also called cryosurgery. A clinician applies it to an unwanted or abnormal area of skin to freeze and destroy selected cells.

Liquid nitrogen is also used to keep laboratory samples, reproductive cells, blood products, and other biological materials at very low temperatures. Outside healthcare, it may appear in scientific work, industry, food preparation, and special-effects displays.

Its medical usefulness and its hazards come from the same two features: it is extremely cold, and it quickly changes from liquid to gas.

How it works

When liquid nitrogen touches warmer material, it boils rapidly. The expanding nitrogen gas is invisible, although it may create a white fog by cooling water in the surrounding air.

During skin cryotherapy, liquid nitrogen may be applied with a spray device, probe, or cotton-tipped applicator. Rapid cooling forms ice inside and around cells. This damages the cells and small blood vessels supplying the treated area. Inflammation then helps the body clear the damaged tissue.

A treated area may become sore, red, swollen, or blistered before forming a scab. These are expected local effects of freezing rather than signs that liquid nitrogen remains in the skin. Healing time is influenced by the size, depth, and location of treatment.

Clinicians use cryotherapy for selected conditions such as warts, actinic keratoses and some other skin growths. An actinic keratosis is a rough area caused by long-term sun damage. Liquid nitrogen may also be used for certain superficial skin cancers when a clinician considers it appropriate.

For storage, samples are kept in specially designed containers called cryogenic vessels or Dewars. The low temperature slows biological and chemical activity. The liquid nitrogen does not usually become part of the stored sample or enter the body.

Why it matters for your health

Planned cryotherapy allows a clinician to destroy a small area of tissue without making a surgical cut. However, freezing also affects nearby healthy cells. The likely benefit must therefore be balanced against pain, blistering, changes in skin colour, and possible scarring.

Liquid nitrogen is not safe to touch, swallow, or place directly in the mouth. Brief contact can freeze tissue. Liquid trapped against the skin, including inside a glove or shoe, may cause a deeper cold injury.

As liquid nitrogen boils, the gas takes up much more space than the liquid. In a poorly ventilated room, this can lower the amount of oxygen available to breathe. Nitrogen itself is not considered poisonous in the usual sense, but too little oxygen can cause headache, confusion, loss of coordination, collapse, or death.

Gas expansion also creates pressure. Liquid nitrogen must never be stored in a completely sealed container because the container can rupture.

What can go wrong

Cold burns and frostbite can follow skin contact. Frostbite means tissue damage caused by freezing. The area may look pale or waxy, feel numb, or later become painful and blistered. Clothing or jewellery can hold the liquid against the body and worsen the injury.

Eye injury can occur from splashes or from cold vapour close to the eye. The cornea, the clear front surface of the eye, is particularly vulnerable to freezing.

Asphyxiation means harm caused by too little oxygen. It is mainly a risk when liquid nitrogen spills or evaporates in an enclosed or poorly ventilated space. Because nitrogen has no smell, you cannot rely on your senses to detect this danger.

Pressure-related container failure can happen if evaporating nitrogen is trapped. A sealed bottle, flask, food container, or pipe may burst and cause impact injuries as well as cold exposure.

Internal cold injury can occur if liquid nitrogen is swallowed before it has fully evaporated from food or drink. Rapid gas expansion inside the digestive tract can also cause severe damage, including a tear or hole in the stomach.

After medically supervised skin cryotherapy, possible complications include infection, delayed healing, pigment changes, scarring, hair loss at the treated spot, and temporary or lasting nerve injury. Pigment changes may be more noticeable in darker skin. These are complications of the procedure, not an illness caused by liquid nitrogen.

Seek routine follow-up if a treated area is not healing as expected, the original skin problem remains, or you are concerned about the cosmetic result.

Contact the treating service promptly for increasing pain, spreading redness, pus, fever, or worsening swelling after cryotherapy. These may indicate infection or another complication.

Call emergency services after swallowing liquid nitrogen, a significant eye splash, collapse in a low-oxygen space, severe breathing difficulty, or a large cold injury. Do not enter an oxygen-deficient area to rescue someone unless you are trained and have suitable breathing equipment.

What you can do

Before cryotherapy, ask what is being treated and why freezing is suitable. Cryotherapy destroys tissue, so it may not leave a sample for laboratory examination. If the nature of a skin growth is uncertain, ask whether it should be examined or biopsied first. A biopsy removes a small sample for testing.

After treatment, keep the written care instructions and note the treatment date and location. Ask how to clean or cover the area, what changes are expected, and when it should be reviewed. If the procedure is recorded in your notes and the area heals normally, there may be nothing else to check.

For a skin exposure, move away from the source. Remove loose wet clothing or jewellery, but do not pull away anything frozen to the skin. Do not rub the area or apply direct heat. Gently warming it with lukewarm water may help while you arrange medical advice.

For an eye splash, begin gentle rinsing with clean lukewarm water and seek emergency assessment. Remove contact lenses only if they come out easily.

If you may have breathed oxygen-poor air, move into fresh air if you can do so safely. Call emergency services if there is confusion, fainting, breathing difficulty, or ongoing unwellness.

In workplaces, ask about training, ventilation, oxygen monitoring, spill procedures, and suitable protective equipment. Liquid nitrogen should be kept only in approved, vented cryogenic containers. An ordinary freezer, drinks flask, or sealed bottle is not suitable.

Do not eat or drink a product while liquid nitrogen is still present. Bubbling, visible pooling, or active preparation with liquid nitrogen means it may not have fully evaporated.

There is no routine blood test for liquid nitrogen exposure. Clinicians assess cold injury by examining the affected tissue. A correctly placed oxygen monitor can measure oxygen in the surrounding air.

Common questions

Is liquid nitrogen the same as dry ice?

No. Liquid nitrogen is liquefied nitrogen gas. Dry ice is solid carbon dioxide. Both are very cold and can injure skin or reduce oxygen in enclosed spaces, but they are different substances.

Is the white cloud nitrogen gas?

Usually not. Nitrogen gas is invisible. The visible cloud is mainly tiny water droplets formed when cold nitrogen cools moisture in the air. The cloud does not show how much oxygen remains in the room.

Can liquid nitrogen poison you?

It is not usually toxic through a chemical poisoning effect. Its main dangers are tissue freezing, oxygen displacement, and pressure from rapid gas expansion.

Can I use liquid nitrogen to remove a wart at home?

Industrial or laboratory liquid nitrogen should not be used for home treatment. Non-prescription wart-freezing products are different and do not necessarily reach the same temperature. Follow their labels and ask a pharmacist or clinician if you are unsure whether a skin growth is a wart.

Does cryotherapy always leave a scar?

No, but scarring is possible. Temporary or lasting lightening or darkening of the skin can also occur. The risk is affected by treatment depth, body site, healing, and your skin.

Does cryotherapy hurt?

It can cause brief stinging or burning during freezing, followed by soreness. Tell the treating clinician beforehand if you are worried about pain or have reduced feeling in the area.

Sources

- Centers for Disease Control and Prevention, National Institute for Occupational Safety and Health. NIOSH Pocket Guide to Chemical Hazards: Nitrogen, refrigerated liquid.
- US Food and Drug Administration. FDA Advises Consumers to Avoid Eating, Drinking, or Handling Food Products Prepared with Liquid Nitrogen at the Point of Sale.
- British Association of Dermatologists. Cryotherapy: Patient Information Leaflet.
- DermNet New Zealand. Cryotherapy.
- Occupational Safety and Health Administration. Laboratory Safety Guidance.