CONDITION

Frostbite

Frostbite is an injury caused when skin and underlying tissues freeze during cold exposure.

WHAT IT IS
Freezing injury to skin and deeper tissues

BODY SYSTEM
Skin, blood vessels, nerves, and deeper tissues

MAIN SYMPTOMS
Numbness, pale skin, swelling, blisters

WHAT CAUSES IT
Tissue freezing during cold exposure

HOW IT IS DIAGNOSED
Clinical examination after rewarming; imaging for severe injury

MAIN TREATMENT
Rapid rewarming, wound care, and specialist hospital treatment

CAN IT BE CURED?
Sometimes - mild injury heals; dead tissue cannot recover

IS IT AN EMERGENCY?
Sometimes - hard, blistered, or persistently numb skin

LONG-TERM OUTLOOK
Mild injury heals; deep injury may cause lasting damage

Overview

Frostbite is an injury caused by freezing. It most often affects the fingers, toes, nose, ears, cheeks, and chin. These areas are exposed easily or receive less warm blood than the centre of the body.

Cold first narrows the small blood vessels near the skin. With continued exposure, ice crystals can form in tissues and blood flow may stop. Damage can continue during and after rewarming because of inflammation and blocked small blood vessels.

A mild cold injury called frostnip causes temporary numbness or skin colour changes but does not freeze or permanently damage tissue. Frostbite is deeper. It may affect the full thickness of the skin, fat, muscles, tendons, nerves, or bone.

The final depth of the injury is often unclear at first. Skin that looks pale and numb outdoors

may become swollen or blistered after it is rewarmed. Severe damage may take days or weeks to define.

Frostbite can occur alongside hypothermia , when the body's core temperature becomes dangerously low. Hypothermia takes priority because it affects the brain, heart, and breathing.

Symptoms

Early frostbite may be difficult to notice because numbness can hide pain. Another person may see skin changes before you feel them.

Possible early symptoms include:

After rewarming, the area may become red or mottled, swollen, and painful. Burning or throbbing pain can be intense as blood flow returns.

Clear blisters usually suggest a more superficial injury. Blisters containing dark or bloody fluid can point to deeper damage. Deeply injured skin may remain numb and can later become blue-grey, purple, or black as damaged tissue separates from healthy tissue.

Skin colour changes may be harder to recognise on brown or black skin. Look for changes from the person's usual colour, together with numbness, firmness, swelling, or blisters.

- Cold, tingling, stinging, or aching skin
- Numbness or loss of normal sensation
- Pale, white, greyish, or waxy-looking skin
- Skin that feels unusually firm or hard
- Reduced movement or clumsiness in fingers or toes

Causes and risk factors

Frostbite develops when tissue becomes cold enough to freeze. It usually follows exposure to air below freezing, particularly when wind removes heat quickly. Wet clothing, tight footwear, and direct contact with ice, frozen metal, or very cold liquids can speed heat loss.

The length of exposure matters, but frostbite does not occur after one fixed amount of time. Temperature, wind, moisture, clothing, circulation, and access to shelter all affect risk.

Risk is higher when someone:

Alcohol can create a feeling of warmth while increasing heat loss and reducing the ability to recognise danger. Some medicines can also affect alertness or circulation, but prescribed

medicine should not be stopped without medical advice.

Infants, older adults, people without reliable shelter, outdoor workers, and people taking part in winter or high-altitude activities may have greater exposure.

- Cannot move easily or leave the cold
- Has wet, tight, or inadequate clothing and footwear
- Has previously had frostbite in the same area
- Smokes or has a condition that reduces blood flow
- Has diabetes or reduced sensation in the hands or feet
- Is exhausted, dehydrated, injured, or at high altitude
- Uses alcohol or drugs that affect judgment or awareness

Diagnosis

Frostbite is usually diagnosed from the history of cold exposure and an examination after the tissue has been rewarmed. There is no single blood test that confirms it.

The healthcare team will check skin colour, temperature, sensation, movement, pulses, swelling, and blisters. They will also look for hypothermia, dehydration, injury, or illness that may have contributed to the exposure.

For a serious injury, tests such as a technetium bone scan, angiography, or magnetic resonance angiography may be used. These show blood flow and help estimate which tissue may survive. They are not usually needed for a mild, superficial injury.

Because the appearance changes over time, follow-up examinations are an important part of diagnosis and planning.

Treatment and management

The first priorities are to leave the cold, replace wet clothing, and check for hypothermia. Handle the affected area gently. Remove rings, watches, or other tight items before swelling increases.

Do not rub or massage frozen skin. Do not use a fire, heating pad, radiator, hot water bottle, or other direct heat. Numb skin can burn without warning. Avoid walking on frostbitten feet unless moving is necessary for safety.

A frozen area should not be deliberately thawed if there is a real chance that it will freeze again.

Refreezing after thawing can cause more tissue damage. If safe evacuation is available and refreezing can be prevented, rapid rewarming is usually done in a circulating warm-water bath, ideally under medical supervision.

During rewarming, the area may be gently moved but should not be rubbed. Pain relief is often needed. The rewarmed tissue is then dried, protected with loose dressings, and elevated where practical. Fingers or toes may be separated with clean, dry material.

Hospital treatment depends on the depth, location, and timing of the injury. It may include:

For selected severe injuries treated soon after thawing, specialists may consider clot-dissolving treatment or intravenous iloprost, a medicine that widens blood vessels and reduces platelet clumping. These treatments require hospital assessment because they are not suitable for every injury.

Antibiotics like amoxicillin or doxycycline are not routinely needed just because frostbite has occurred. They may be used if there is evidence of infection or another specific reason.

Surgery to remove damaged tissue is often delayed while the boundary between living and dead tissue becomes clear. Immediate surgery may be needed if there is serious infection, dangerous pressure within a limb, or another urgent complication.

- Wound and blister care
- Pain and inflammation treatment
- Tetanus vaccination when needed
- Medicines that improve blood flow or break down clots
- Imaging to assess circulation in deeper injuries
- Surgery for infection or tissue that cannot survive

Complications

Superficial frostbite may heal without major tissue loss. Deeper frostbite can damage nerves, blood vessels, joints, muscles, and bone.

Possible long-term effects include persistent numbness, altered sensation, chronic pain, stiffness, excessive sweating, and increased sensitivity to cold. Some people develop colour changes or swelling during cold weather.

Damaged tissue may become infected. Severe injury can lead to tissue death and the loss of part of a finger, toe, or limb. This is not always clear during the first examination.

Rarely, very damaged muscle can release substances that strain the kidneys. Serious frostbite

can also have an emotional impact, especially when it affects mobility, work, or independence.

Prevention

Most frostbite can be prevented by limiting exposure and keeping skin warm and dry. Check the weather and wind chill before outdoor activity, and plan how you will reach shelter if conditions change.

Wear loose layers that trap warm air without restricting circulation. Use insulated, water-resistant footwear, warm socks, mittens, a hat, and protection for the face and ears. Replace wet clothing promptly.

During cold exposure:

Chemical hand or foot warmers can help, but they should not sit directly against numb skin. Tight boots or multiple compressed socks can reduce circulation rather than improve warmth.

People who have had frostbite may remain more sensitive to cold. Extra protection and earlier shelter breaks can reduce the chance of another injury.

- Check fingers, toes, ears, and exposed skin regularly
- Watch companions for pale skin, numbness, or unusual clumsiness
- Keep moving without becoming sweaty
- Take warm shelter breaks before numbness develops
- Carry dry clothing and emergency supplies for remote trips
- Avoid alcohol when cold exposure is likely

Living with it and what to expect

Recovery depends mainly on how deeply the tissue froze. Frostnip improves after warming and does not cause permanent tissue damage. Superficial frostbite may settle over days to weeks, although swelling, skin peeling, and sensitivity can continue longer.

Deep injuries develop more slowly. Blisters and swelling appear after thawing, while the final boundary of damaged tissue may take weeks or months to become clear. Follow-up may involve wound care, repeated examinations, imaging, physical therapy, or surgical review.

Keeping appointments is routine and important, even when the area looks stable. Seek earlier review if pain, swelling, drainage, or skin colour suddenly worsens.

Some people recover normal movement and sensation. Others have lasting numbness, pain,

stiffness, or cold sensitivity. Rehabilitation, protective clothing, pain management, and changes to work or outdoor activities can help people remain active. A previous frostbite injury does not guarantee another one, but the affected area may need more protection in future cold conditions.

When to get medical help

Call emergency services if cold exposure is accompanied by signs of hypothermia, such as confusion, unusual drowsiness, slurred speech, poor coordination, slow or shallow breathing, or loss of consciousness. Move the person to shelter if this can be done safely, but do not delay emergency help.

Get urgent medical assessment for skin that is frozen, hard, waxy, blistered, deeply discoloured, or still numb after gentle rewarming. Significant swelling, loss of movement, severe pain, or frostbite affecting a large area also needs prompt care.

Do not wait for skin to turn black. That is a late change and is not required for frostbite to be serious.

After a diagnosed injury, contact the healthcare team promptly if there is spreading redness, increasing warmth or swelling, pus, a bad smell, fever, or pain that is getting worse rather than better. These can be signs of infection or another complication.

Mild frostnip that returns fully to normal after warming may not require emergency treatment. Routine medical advice is still reasonable if symptoms recur, sensation does not completely return, or you are unsure whether the tissue froze.

Common questions

What does frostbite look like?

Early frostbite may look pale, white, greyish, or waxy. The skin can feel firm and numb. After warming, it may become red or mottled, swollen, and blistered. Deep damage can later appear blue-grey, purple, or black.

Appearance alone cannot show the full depth during the first few hours. Persistent numbness, hardness, or blistering is more important than one particular colour.

What is the difference between frostnip and frostbite?

Frostnip is a temporary cold injury. The skin may feel numb or painful, but it stays soft and returns to normal after gentle warming. It does not permanently damage tissue.

Frostbite means tissue has frozen. The area may remain numb, feel hard, swell, or form blisters after rewarming. Medical assessment helps distinguish the two when symptoms do not resolve fully.

How long does frostbite take to heal?

A superficial injury may improve over days or weeks. Deep frostbite can take several months to declare its full extent and heal. Recovery time reflects the depth of injury, the tissue affected, blood flow, infection, and whether surgery is needed.

Should I pop frostbite blisters?

No. Popping a blister outside a clinical setting can damage the tissue and increase infection risk. Protect it with a clean, loose dressing and seek medical advice. A healthcare professional may drain or remove certain blisters as part of planned wound care.

Does frostbite always lead to amputation?

No. Many superficial injuries heal without tissue loss. Amputation is considered when deep tissue has died, infection threatens health, or a non-healing area causes serious problems. Specialists often wait for the injury boundary to become clear before making this decision.

Can I use snow to rub frostbite?

No. Rubbing with snow adds cold exposure and creates friction, which can damage fragile tissue. Move to shelter, remove wet clothing, protect the area, and use controlled warm-water rewarming only when refreezing can be prevented.

Sources

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