DermNet NZ

Authoritative facts about the skin from the New Zealand Dermatological Society Incorporated.

Frostbite

What is frostbite?

Frostbite is a condition where the skin and underlying tissue actually freeze. It occurs when body parts, usually the extremities such as the toes, feet, fingers, ears, nose and cheeks are exposed to extremely cold conditions. The condition rarely occurs in fit and healthy individuals in still air temperature above minus 10 degrees Celsius but may do so at higher temperatures in high winds due to the wind chill effect.

What causes frostbite?

Certain processes taking place in the body, in response to exposure to extreme cold, cause frostbite.

- Firstly, blood flow to the skin and extremities is slowed down as blood vessels constrict (narrow). This occurs so blood can be redirected to the vital organs to keep the body alive and warm. Ice crystals form in the tissues, the blood vessel walls are damaged and the cells start to break down.
- Secondly, with continued exposure to the cold, as the extremities get colder and colder, the blood vessels dilate (widen) for a brief period before constricting again. This happens because the body is trying to preserve as much function in the extremities as possible. However, the blood returning to the extremities leaks out through the leaky blood vessels. This causes further damage to the tissues.

Who gets frostbite?

Certain groups of people are at greater risk of getting frostbite than others, these include:

- Winter and high-altitude athletes, e.g. mountaineers and skiers
- Individuals stranded in extreme cold weather conditions
- Soldiers, cold weather rescuers and labourers working in cold environments
- Homeless people
- Very young and the very old people
- People with decreased blood flow to the extremities such as those with peripheral vascular disease or diabetes
- Those taking certain drugs that constrict blood vessels, e.g. nicotine (smoking) or beta blockers

What are the signs and symptoms?

The signs and symptoms of frostbite include coldness, firmness, stinging, burning, numbness, clumsiness, pain, throbbing, excessive sweating, pallor or blue skin discolouration, rotting skin and gangrene. Frostbite has been classified under the following categories that relate to the degree of injury.

First-degree frostbite

This is also called frost nip and occurs in people who live in very cold climates or do a lot of outdoor activity in winter. It involves the top layer of skin (epidermis) and presents as numbed skin that has turned white in colour. The skin may feel stiff to touch, but the tissue underneath is still warm and soft. Blistering, infection or scarring seldom occurs if frost nip is treated promptly.

Second-degree frostbite

This is superficial frostbite and presents as white or blue skin that feels hard and frozen. Blisters usually form within 24 hours of injury and are filled with clear or milky fluid. The tissue underneath is still intact but medical treatment is required to prevent further damage.

Third-degree frostbite

Deep frostbite appears as white, blotchy and/or blue skin. The underlying skin tissue is damaged and feels hard and cold to touch. Blood-filled blisters form black thick scabs over a matter of weeks. Proper medical treatment by personnel trained to deal with severe frostbite is required to help prevent severe or permanent injury. Amputation may be required to prevent severe infection.

Fourth-degree frostbite is where full-thickness damage affects muscles, tendons, and bone, with resultant tissue loss.

What treatment is available?

Prior to reaching a place that can provide proper medical attention the following should take place.

- Shelter patient from the cold and move to a warmer place.
- Replace wet clothing with dry soft clothing to minimise further heat loss.
- Do not try to thaw frostbite unless in a warm place (warming and then re-exposing frozen parts to the cold cause permanent damage).
- Do not rub the affected area with warm hands or snow, apply direct heat such as heater, fire or heating pad, as this can cause further injury.
- Warm the entire body, not just the frostbitten parts, by wrapping in blankets and protecting the frostbitten parts until a suitable place is reached to start the rewarming process.

Once the patient has reached an appropriate facility the rewarming process can take place. Rewarming should be rapid to avoid further damage.

- An appropriate warming technique is the use of a whirlpool bath or tub of water at 40-42 degrees Celsius. Avoid warmer temperatures or dry heat because of the risk of thermal injury.
- Warm wet packs at the same temperature can be used if a water tub is not available.
- Rewarming or thawing usually takes about 20-40 minutes and is complete when tips of the affected area flush, the skin is soft and sensation returns.
- Apply dry, sterile dressings to the frostbitten areas and place between fingers and toes to keep them separated. Try to restrict movement of the affected areas as much as possible.
- Clean any dead tissue around clear blisters but leave blood-filled blisters intact to reduce the risk of infection.
- Analgesics such as morphine sulphate may be administered for pain. The thawing out can be very painful.

Within days of the thawing process further blisters may form. These should settle after about a week but may leave behind dead blackened tissue that form scabs. If the frostbite is superficial, pink new skin will appear beneath the scab. If frostbite is deep, the end of the finger or toe will gradually separate off. In some cases surgery may be required to remove dead tissue. This is not usually performed until 3-4 weeks after the initial injury, as the full extent of damage to tissues is not usually complete until this time.

Related information

References:

- Book: Textbook of Dermatology. Ed Rook A, Wilkinson DS, Ebling FJB, Champion RH, Burton JL. Fourth edition. Blackwell Scientific Publications.

On DermNet NZ:

- Chilblains

Other websites:

- Frostbite – emedicine dermatology, the online textbook

Books about skin diseases:

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