COLD WEATHER INJURIES

Frostbite and Cold Weather-Related Injuries Facts

- Cold weather-related injuries occur with and without freezing of body tissues.
- Cold weather-related injuries include chilblains, trench foot, frostnip, and frostbite.
- Signs and symptoms may include tingling, numbness, and changes in the color and texture of the skin.
- Treatment generally includes moving out of the cold environment, removing wet clothing, and re-warming the affected area.
- Frostbite is a serious cold weather-related injury that requires immediate medical attention and rapid re-warming. Do not thaw the affected area if there is the risk of refreezing.
- Certain individuals, such as the elderly, children, alcoholics, and the homeless, are at increased risk of developing cold weather-related injuries.
- Prevention of cold weather-related injuries is best accomplished through proper planning and preparation for cold weather.

Introduction to frostbite and cold weather-related injuries

Winter cold and snow provide a number of opportunities to get outside and participate in activities such as skiing, sledding, and snowmobiling. However, without proper protection, cold weather-related injuries can occur even when temperatures are above freezing (32 F, 0 C). This is especially true if there are high winds or if clothing is wet. In general, however, it is both the temperature and the duration of exposure that play a role in determining the extent and severity of cold weather-related injuries. This information describes the different types of cold weather-related injuries, as well as what to do to prevent and treat them prior to reaching a health care practitioner.

What type of injuries can be caused by cold weather?

Cold weather-related injuries can be divided into two general categories. There are those injuries that occur without the freezing of body tissue, such as chilblains, trench foot, and frostnip, and those injuries that occur with the freezing of body tissue, such as frostbite. Hypothermia is a medical condition characterized by a core body temperature that is abnormally low.

Cold weather-related injuries without tissue freezing

Chilblains

Chilblains (also known as pernio) are a common type of cold weather-related injury that can develop in predisposed individuals after exposure to nonfreezing temperatures and humid conditions. Chilblains typically develop because of an abnormal vascular response several hours after the area exposed to cold is re-warmed. Chilblains are itchy, painful, reddish, or purplish areas of swelling that usually affect the fingers, toes, nose, or ears. In some individuals, blisters or small open sores may also form, increasing the risk for developing an infection. Chilblains usually last for several days, and the affected area usually heals after several weeks. Though the affected area may remain sensitive to the cold in the future, there is usually no permanent damage. It is not uncommon for chilblains to recur in susceptible individuals.

Trench foot

Trench foot was named after the condition suffered by many soldiers in the trenches during World War I, though it is a condition still encountered today, often found in homeless individuals. Trench foot develops
The symptoms of trench foot may include pain, itching, numbness, and swelling. The affected foot may appear red, or blotchy (red and pale areas mixed together) or even bluish-black with advanced injury. As with chilblains, blisters and open sores can develop. With severe trench foot, the tissue dies and sloughs off, and the development of gangrene can occur, sometimes requiring amputation. The usual recovery period for uncomplicated trench foot can be several weeks.

**Frostnip**

Frostnip is a mild cold weather-related injury that typically affects the face, ears, toes, and fingers. After exposure to cold weather, the affected area may appear pale, and may be accompanied by burning, itching or pain. Tingling or numbness are frequently present. Simple re-warming restores normal color and sensation, and there is no subsequent permanent tissue damage.

**Cold weather-related injuries with tissue freezing**

**Frostbite**

Frostbite occurs when there is freezing of body tissue, and it is the most serious of the cold weather-related injuries. Frostbite usually affects the hands, feet, nose, ears, and cheeks, though other areas of the body may also be affected. This type of injury results from decreased blood flow and heat delivery to body tissues resulting in damaging ice crystal formation, which ultimately leads to cell death. Upon re-warming of the affected tissue, vascular damage and complex cellular metabolic abnormalities lead to tissue death. Damage to tissue is most pronounced when there is prolonged cold weather exposure, the affected area slowly freezes, and the subsequent re-warming process is slow. Repeated thawing and refreezing of the affected tissue is particularly damaging, and should be avoided.

Frostbite injuries can be classified as either superficial or deep, depending on the tissue depth of injury. Superficial frostbite injuries involve the skin and subcutaneous tissues, while deep frostbite injuries extend beyond the subcutaneous tissues and involve the tendons, muscles, nerves, and even bone. Superficial frostbite injuries have a better prognosis than deep frostbite injuries.

**What are the signs and symptoms of frostbite?**

The signs and symptoms of frostbite depend on the extent and depth of tissue injury. Individuals with superficial frostbite may experience the following signs and symptoms to the affected area:

- pain,
- burning,
- tingling,
- numbness,
- pale colored skin,
- clear-colored skin blisters may develop, and
- firm-feeling skin with soft underlying tissue which can move over bony ridges.

As the degree of injury progresses (1st to 3rd) to involve deeper tissue structures, the signs and symptoms of deep frostbite can develop, which may include the following:

- complete loss of sensation,
- pale, yellowish, bluish, gray, or mottled skin color,
- formation of blood-filled skin blisters, and
• firm-feeling skin and underlying tissue, with the affected area feeling hard and solid. With advanced frostbite injuries, the affected area can subsequently appear blackened and gangrene can develop, placing the affected individual at high-risk for infection.

**How should frostbite and other cold weather-related injuries be treated?**

The initial treatment for any cold weather-related injury involves removing yourself or others from the precipitating cold environment, if possible, to prevent further heat loss. Move indoors, and remove all wet clothing and constricting clothing (such as socks, boots, and gloves), and replace with dry clothing. Avoid massaging or rubbing the affected area, as this will only aggravate the injury. It is important to note that some of these individuals may also be suffering from hypothermia, a potentially life-threatening condition.

**Chilblains**

• Gradually re-warm the affected area, and treatment can generally be accomplished at home. Some individuals may benefit from various lotions, while others may require treatment with corticosteroid creams. If open sores develop, they should remain clean and be monitored for signs of infection.

**Trench foot**

• Individuals with trench foot should have their wet shoes and socks removed, and the feet should be elevated, cleaned and air dried. Depending on the severity of the condition, some individuals may require antibiotics and/or surgical management of infection or wet gangrene (tissue destruction by bacterial infection, usually *Clostridium spp*).

**Frostnip**

Frostnip will generally improve with conservative re-warming measures at home. Frostnip to the hands, for example, can be treated by breathing into cupped hands or placing the hands in the armpit area. Alternatively, the affected area can be submerged in warm water until normal sensation is restored.

**Frostbite**

• Frostbite requires immediate medical attention. Ideally, treatment should be instituted in a healthcare facility, when possible.

• Prior to transport to a health-care facility, if possible, loosely wrap the affected area in a dry sterile bandage or a clean blanket to prevent further trauma. Cotton may be placed between the toes or fingers, if affected, to prevent any potential damaging effects of rubbing against one another.

• The most effective treatment measure for frostbite is rapid re-warming. This is accomplished by immersing the affected area into a circulating tub of warmed water that is between 40 to 42 C (104 to 108 F) for 20 to 40 minutes or until thawing is complete. Warm wet packs at the same temperature may be used if a tub is not available.

  o It is important NOT to rapidly re-warm and thaw the affected area if there is a risk that it may refreeze. This leads to more severe tissue damage and must be avoided.

  o During the re-warming process, the pain may be extreme and oral or intravenous analgesics may be required.

• After rapid re-warming is complete, the affected area should be dressed and splinted. Further treatment will focus on wound care (debriding clear blisters, applying aloe vera lotion, and monitoring for infection), pain control, and providing a tetanus vaccine booster shot, if needed. Surgical consultation may be obtained for managing wound care, as well as for the longer-term sequelae of serious frostbite injuries that may require amputation of gangrenous tissue.

**What is the recovery time for a frostbite injury?**

The recovery time for a frostbite injury depends on the extent of tissue injury and whether or not there are any subsequent complications, such as infection. It may take 1 to 3 months before it is possible to determine the extent of tissue damage, and to clearly delineate which tissue is still viable. Some individuals will require debridement, skin grafting, or amputation of the affected area. Approximately 65%
of patients will experience long-term sequelae from frostbite injuries, such as sensitivity to the cold with associated pain or burning, arthritis, increased sweating, and tingling of the affected area. Rarely, death occurs from infection-related complications.

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