Frostbite, the most common type of freezing injury, is defined as the freezing and crystallizing of fluids in the interstitial and cellular spaces due to exposure to freezing temperatures. Frostbite can result from exposure to extreme cold, 14°F (-10°C). However, frostbite can also set in slowly, depending on how long the skin is exposed to the cold and how cold and windy it is. Although frostbite is predominantly a winter emergency, it can occur year round, such as if a person is accidentally trapped in a walk-in freezer.

Frostbite results from the body's survival mechanisms. During freezing temperatures, the body acts to protect the vital inner organs by decreasing circulation to peripheral body parts, such as the feet and hands. Vasoconstriction occurs and as a result the fluid in and around skin cells develops ice crystals. Additionally, red blood cells and platelets may clump and obstruct capillaries, causing ischemic damage.

In cold temperatures, people tend not to get thirsty and dehydration often occurs, contributing to the development of frostbite. Hydration increases the blood's volume, which helps prevent frostbite. To maintain hydration, certain beverages should be avoided during exposure to cold, including caffeinated beverages and alcohol. Caffeinated drinks constrict blood vessels and can impair peripheral circulation. Although alcohol does serve to dilate blood vessels, which is helpful to increase circulation, it should also be avoided. Among other adverse effects, alcohol reduces shivering, which is one way the body attempts to keep warm.

4. Altered mental state: Persons with head trauma, drug abuse, psychiatric illness or fatigue are at high risk for frostbite. Such conditions can alter mental alertness, reduce the sensations signaling frostbite, lead to careless behavior and/or decreased recognition of initial signs of frostbite.

5. Cigarette smoking: Smoking causes vasoconstriction and can significantly decrease blood flow to the extremities during cold weather, thus increasing the risk of frostbite. Additionally, persons of any age taking vasoconstrictive drugs, such as migraine medications, are also at risk.

1. Age-specific: Although frostbite can occur at any age, adolescents and the elderly are considered at higher risk. Developmentally, adolescents are characteristically spontaneous and may not dress appropriately for the cold. For example, it may not be “cool” to wear appropriate protective clothing, such as a wool cap or scarf. This age-group is also unlikely to leave their peers and the outdoor winter activities they are engaged in, such as sledding or skiing, when they are cold. Because metal jewelry conducts cold, the risk of frostbite of that area is increased. Multiple body piercings, such as of the nose, eyelid, lips, as well as the ears, are common in many adolescents, females, as well as males.

Due to physiologic changes associated with aging, the elderly are also at risk for the development of frostbite. Aging adults typically lose heat from their skin more rapidly than those who are younger. Therefore, brief exposure to freezing temperatures can cause frostbite in this population. Additionally, with aging, impaired peripheral circulation is often common, further increasing the risk. Persons of any age, who have diabetes, are also more susceptible to frostbite.

2. Environment: The homeless, often continuously exposed to freezing temperatures, are obviously highly susceptible to frostbite. Persons who work outside in cold climates, as well as winter and high-altitude athletes, are also at risk. High altitudes are associated with lower temperatures, as well as an increasing risk of becoming lost or exhausted, prolonging exposure to freezing temperatures.

3. Hydration: In cold temperatures, people tend not to get thirsty and dehydration often occurs, contributing to the development of frostbite. Hydration increases the blood's volume, which helps prevent frostbite. To maintain hydration, certain beverages should be avoided during exposure to cold, including caffeinated beverages and alcohol. Caffeinated drinks constrict blood vessels and can impair peripheral circulation. Although alcohol does serve to dilate blood vessels, which is helpful to increase circulation, it should also be avoided. Among other adverse effects, alcohol reduces shivering, which is one way the body attempts to keep warm.

1. Discuss characteristics of frostbite, as well as risk factors, including age-specific considerations.

2. Describe assessment findings, emergency and long-term management of frostbite with related implications for healthcare providers.

This newsletter will define frostbite, as well as risk factors, including age-specific considerations. Assessment findings, emergency and long-term management, with related implications for healthcare providers, will also be described.
6. Insufficient or restrictive, protective clothing in freezing temperatures. Areas of the body most prone to frostbite are the fingers, toes, hands, feet, chin, tip of the nose, earlobes, and cheeks. These areas should be protected, such as by wearing insulated socks and boots that fit properly. Tight boots can impair blood circulation to the feet and legs. A hat and scarf, to cover the ears and the face, should also be worn. Mittens, ideally waterproof and insulated, are more effective than gloves for warming and protecting the hands. And, because hypothermia may be associated with frostbite, wearing several layers of warm clothes, under a windproof and waterproof coat, is also recommended. Any wet clothing should be changed immediately, as it is a poor insulator, drawing heat from the body, and promoting frostbite development.

ASSESSMENT

Frostbite can result in various degrees of skin damage, from superficial to deep tissue damage. The depth of tissue loss depends on the duration of exposure, as well as the environmental temperature. Frostbite, like thermal burns, are classified according to which layers of skin are injured.

- First-degree frostbite involves the outer layer of skin, the epidermis. Superficial frostbite is often referred to as ‘frostnip.’ The area may appear pale and a prickly sensation, as well as pain, may be present.
- Second-degree frostbite is a partial-thickness cold injury involving the epidermis, as well as the next layer of skin, the dermis, either partially or completely. The skin often appears yellowish, gray or white color, which may Blanch slowly or not at all. Pain is often severe. And, large-filled blisters are a classic sign of this degree of injury. Swelling may also occur in the affected area.
- A third-degree injury consists of a full-thickness cold injury, freezing all layers of skin and extending to the muscle, tendons, nerves and bone. The affected body part is typically cold, numb, painless, and bloodless, with no blisters or edema present. The skin may appear cyanotic or red, and does not Blanch with pressure. If an extremity is involved, loss of function is common.
- The skin is often leathery to the touch and gangrene is a real threat.

PROGRESSIVE SIGNS OF FROSTBITE

When exposed to freezing temperatures, the skin should be checked every 10-20 minutes for frostbite. Progressive assessment of frostbitten skin areas include:

- Coldness, initially
- Numbness
- Stinging, burning, and throbbing pain
- Loss of fine muscle dexterity, such as clumsiness of finger.
- Loss of large muscle dexterity, such as difficulty ambulating.
- Complete loss of function and sensation.

MANAGEMENT

Until the mid-1950’s, frostbite treatment consisted of rubbing snow over the affected area. Since first tried in Alaska in 1956, rapid re-warming is considered the most effective treatment for frostbite. Specific treatment of frostbite depends on the severity of skin damage, as well as the setting.

First-degree frostbite typically can be treated quickly and easily at home. Second- and third-degree frostbite requires emergency medical attention. The main priority, in all types of frostbite, and in any setting, is re-warming. The following are guidelines regarding what to do and what not to do when a person is at risk for frostbite.

DO:

- Get the victim into dry clothing.
- Remove the person’s jewelry, especially rings and earrings.
- If a victim’s feet are frostbitten, the person should be carried, if at all possible.
- Warm frostbitten areas rapidly. The longer a part remains frozen, the greater the ultimate damage may be. If the frostbitten area involves the nose or ear, warm compresses may be used. A bath or basin should be used. The water temperature should be lukewarm. If a thermometer is available, the water should be maintained at about 40.5 °C (105 °F). Immerse the affected body part for periods of 20-30 minutes, gently moving fingers and toes, if involved. Or, if the frostbitten area involves the nose or ear, warm compresses may be used.
- Re-assess the frost-bitten area frequently. When re-warmed, frostbitten skin often becomes blotchy red, swollen and blisters form, which should be left intact.
- A burning, painful sensation typically occurs as re-warming takes place. Ibuprofen may be included in the management of frostbite because of its anti-inflammatory properties.
- Re-hydrate the victim, since victims of frostbite are often dehydrated. Warm, de-caffeinated beverages and/or intravenous fluids may be appropriate.
- Keep affected areas dry and open to warm air. An involved extremity should be elevated to lessen edema. Have the patient keep thawed areas as still as possible.
- Prevent infection. The most important emergency treatment after re-warming is to keep the skin as clean as possible to avoid infection. Sterile dressings should be applied between affected fingers and toes. Antibiotics may be ordered, as well as tetanus toxoid, if immunizations are not up to date.

DO NOT:

- use direct heat, such as a fire or heating pad to re-warm the skin.
- rub frostbitten skin.
- put snow on the area or immerse the area in cold water.
- thaw the area, if refreezing is a risk, such as if the person is away from immediate help, because severe tissue damage can result.

Healthcare professionals play a key role in teaching at-risk patients measures to prevent frostbite, as well as providing emergency management.
POULATION/AGE-SPECIFIC EDUCATION POST TEST

GROWN UP… A Newsletter for Those Who Care for Adolescents, Adults and Aging Adults

January 2009

Competency: Demonstrates Age-Specific Competency by correctly answering 9 of 10 questions related to Frostbite…Age-Specific Risk Factors & Management.

FROSTBITE … AGE-SPECIFIC RISK FACTORS & MANAGEMENT

1. Frostbite is best defined as:
   a. freezing and crystallizing of fluids in the interstitial and cellular spaces.
   b. vasodilation of blood vessels and decreased central circulation.
   c. prolonged exposure to rainy, chilly temperatures.
   d. a survival mechanism to protect neurologic function.

2. Frostbite is most likely to rapidly occur:
   a. in temperatures of –10oC (14oF) or below.
   b. in the adult population.
   c. when it snows or sleets.
   d. when wind chill is not a factor.

3. Which of the following DOES NOT contribute to the development of frostbite?
   a. Cigarette smoking
   b. Vasodilating drugs
   c. Alcohol consumption
   d. Caffeinated drinks

4. Symptoms of frostbite are progressive. Which of the following is a late sign that a person is suffering from frostbite?
   a. Throbbing and burning of the skin
   b. Generalized numbness
   c. Loss of function of the affected area
   d. Confusion and stinging of the skin

5. To prevent frostbite, patients should be taught when in freezing conditions to keep wet clothing on, since it provides effective insulation and protection.
   a. True
   b. False
FROSTBITE ... AGE-SPECIFIC RISK FACTORS & MANAGEMENT

6. Which of the following characteristics is an age-specific factor contributing to frostbite development in adolescents? They:
   a. have poor peripheral circulation.
   b. don’t want to leave their peers or activities to get warm.
   c. are apt to stay indoors during snowy and freezing weather.
   d. have a smaller body surface area than adults or aging adults.

7. Regardless of the degree of frostbite, the immediate priority is to:
   a. re-warm the area.
   b. prevent infection.
   c. offer pain relief measures.
   d. massage the area with snow.

8. Which of the following is appropriate, initial emergency management for frostbite?
   a. Use direct heat, such as a heating pad, to warm the skin.
   b. Place cold compresses on the affected area.
   c. Rub snow on the area.
   d. Immerse the affected area in lukewarm water.

9. Which of the following is important to teach patients at risk for developing frostbite?
   a. Wear gloves, instead of mittens, since they are more effective in warming the hands.
   b. Cover feet and hands when exposed to cold temperatures.
   c. Wear tight boots, to protect the feet from cold air and snow.
   d. Curtail all outdoor activities, staying indoors during freezing temperatures.

10. Which of the following is NOT a common site for frostbite to develop?
   a. Nose
   b. Ear lobes
   c. Abdomen
   d. Fingers