COLD- AND HEAT-RELATED EMERGENCIES


FROSTBITE (congelatio in medical terminology) is the medical condition whereby damage is caused to skin and other tissues due to extreme cold. At or below -15° C (5° F), blood vessels close to the skin start to narrow (constrict). This helps to preserve core body temperature. In extreme cold or when the body is exposed to cold for long periods, this protective strategy can reduce blood flow in some areas of the body to dangerously low levels. The combination of cold temperature and poor blood flow can cause severe tissue injury by freezing the tissue. Frostbite is most likely to happen in body parts farthest from the heart, and those with a lot of surface area exposed to cold. The initial stages of frostbite are sometimes called "frostnip", some people can feel these, some not.

Image from www.geocities.com/abaccola/frostbite.html

SYMPTOMS

Generally, frostbite is accompanied with discoloration of the skin, along with burning and/or tingling sensations, partial or complete numbness, and possibly intense pain. If the nerves and blood vessels have been severely damaged, gangrene may follow, and amputation may eventually be required. If left untreated, frostbitten skin gradually darkens after a few hours. Skin destroyed by frostbite is completely black and looks loose and flayed, as if burnt.

Image from: www.aad.gov.au

TREATMENT

To treat frostbite, one should move the victim to a warm, safe area. If medical attention is easily reachable, wrap the affected areas with dressings and/or cloths. Do not rub or massage affected areas. Also, if it is unlikely that the affected areas can be kept thawed, treatment should not be carried out due to the fact that thawing followed by a second round of freezing can cause more extensive and severe damage to the frostbitten areas. Otherwise, one should place the affected areas in warm (not hot) water, until the areas are soft and sensation has returned. Afterwards, wrap the areas in clean, sterile dressings and attempt to reach medical help (if necessary). If hypothermia has occurred, treat the hypothermia first.

Image from www.geocities.com/abaccola/frostbite.html

“A good portion of the tip of the nose was frozen, and mostly recovered from the damage.”
HYPOTHERMIA refers to any condition in which the temperature of a body drops below the level required for normal metabolism and/or bodily function to take place. In warm-blooded animals, core body temperature is maintained at or near a constant level through biologic homeostasis. When the body is exposed to colder temperatures, however, its internal mechanisms may be unable to replenish the heat that is being lost to the body's surroundings.

**Stages of Hypothermia in Humans**

**Stage 1**
Body temperature drops by 2°C - 4°C below normal temperature (37°C) (1.8°-3.6°F, or between 96.8°F - 95°F). Mild to strong shivering occurs. Unable to perform complex tasks with the hands; the hands become numb. Blood vessels in the outer extremities contract, lessening heat loss to the outside air. Breathing becomes quick and shallow. Goose bumps form, raising body hair on end in an attempt to create an insulating layer of air around the body (limited use in humans due to lack of sufficient hair, but useful in other species).

**Stage 2**
Body temperature drops by another 2°C - 4°C (3.6°F - 7.2°F, or between 95°F - 91.4°F). Shivering becomes more violent. Muscle mis-co-ordination becomes apparent. Movements are slow and labored, accompanied by a stumbling pace and mild confusion, although the victim may appear alert. Surface blood vessels contract further as the body focuses its remaining resources on keeping the vital organs warm. Victim becomes pale. Lips, ears, fingers and toes may become blue.

**Stage 3**
Body temperature drops below approximately 32°C or 90°F (normal is 37°C or 98.6°F). Shivering usually stops below 32°C; difficulty speaking, sluggish thinking, and amnesia start to appear; inability to use hands and stumbling are also usually present. Cellular metabolic processes shut down. Below 86°F (30°C) the exposed skin becomes blue and puffy, muscle coordination very poor, walking nearly impossible, and the victim exhibits incoherent/irrational behavior including terminal burrowing behavior or even a stupor. Pulse and respiration rates decrease significantly but fast heart rates (ventricular tachycardia, atrial fibrillation) can occur. Major organs fail. Clinical death occurs.

Because of decreased cellular activity in stage 3 hypothermia, the body will actually take longer to undergo brain death.

**FIRST AID**

If any symptoms of hypothermia are present, especially confusion or changes in mental status, the local emergency service should be immediately contacted. If the person is unconscious, check their airway, breathing, and circulation. Pulse check should take at least 45 seconds, as the heart rate may be extremely slow. If necessary, begin rescue breathing or CPR. If the victim is breathing less than 6 breaths per minute, begin rescue breathing.

Take the person inside to room temperature and cover him or her with warm blankets. If going indoors is not possible, get the person out of the wind and use a blanket to provide insulation from the cold ground. Cover the person's head and neck to help retain body heat.

Once inside, remove any wet or constricting clothes and replace them with dry clothing. Warm the person. Apply warm compresses or packs to the neck, chest wall, armpits and groin. If the person is alert and can easily swallow, give warm, sweetened, non-alcoholic fluids to aid the warming. Stay with the person until medical help arrives. Assume that you should obtain a doctor if the victim has been exposed for 24 hours or more.

**DO NOT** use your own body heat to re-warm the subject, this may very well cause you to become hypothermic.

**DO NOT** assume that someone found lying motionless in the cold is already dead.

**DO NOT** use direct heat (such as hot water, a heating pad, or a heat lamp) to warm the person.

**DO NOT** give the person alcohol.

**DO NOT** rub the person's limbs because this may cause further tissue damage.

**HANDLE** with extreme care. Any rough handling of an extremely hypothermic person could cause their heart to stop. Get them out of the cold, but do it gently.
Hypothermia (hyperpyrexia), in its advanced state referred to as heat stroke or sunstroke, is an acute condition which occurs when the body produces or absorbs more heat than it can dissipate. It is usually due to excessive exposure to heat. The heat-regulating mechanisms of the body eventually become overwhelmed and unable to effectively deal with the heat, and body temperature climbs uncontrollably. This is a serious medical emergency that requires immediate medical attention.

Progression

Body temperatures above 40 °C (104 °F) are life-threatening. At 41 °C (106 °F), brain death begins, and at 45 °C (113 °F) death is nearly certain. Internal temperatures above 50 °C (122 °F) will cause rigidity in the muscles and certain, immediate death. Heat stroke may come on suddenly, but usually follows a less-threatening condition commonly referred to as heat exhaustion or heat prostration.

Signs and Symptoms

Heat prostration, or heat exhaustion, is characterized by mental confusion, muscle cramps, and often nausea or vomiting. At this stage the victim will likely not be sweating. With continued exposure to ambient heat, which sometimes is facilitated by the mental confusion, temperature may rise into the 39 to 40 °C range (103 to 104 °F), and lead to full-blown heat stroke.

One of the body's most important methods of temperature regulation is perspiration. This process draws heat from inside, allowing it to be carried off by radiation and/or convection. Evaporation of the sweat furthers the cooling process, since this is an endothermic process that draws yet more heat from the body. When the body becomes sufficiently dehydrated to prevent the production of sweat, this avenue of heat reduction is closed. When the body is no longer capable of sweating, core temperature begins to rise swiftly.

Victims may become confused, may become hostile, often experience headache, and may seem intoxicated. Due to dehydration, blood pressure may drop significantly, leading to possible fainting or dizziness, especially if the victim stands suddenly. As blood pressure drops, heart rate and respiration rate will increase (tachycardia and tachypnea) as the heart attempts to supply enough oxygen to the body. The skin will become red as blood vessels dilate in an attempt to increase heat dissipation. As heat stroke progresses, the decrease in blood pressure will cause blood vessels to contract, resulting in a pale or bluish skin colour. Complaints of feeling hot may be followed by chills and trembling, as is the case in fever. Some victims, especially young children, may suffer convulsions. Acute dehydration such as that accompanying heat stroke can produce nausea and vomiting; temporary blindness may also be observed. Eventually, as body organs begin to fail, unconsciousness and coma will result.

First Aid

Heat stroke is a medical emergency requiring hospitalization, and the local emergency system should be activated as soon as possible.

The body temperature must be lowered immediately. The victim should be moved to a cool area (indoors, or at least in the shade) and clothing removed to promote heat loss (passive cooling). Active cooling methods may be used: The person is bathed in cool water, a hyperthermia vest can be applied, or wrapped in a cool wet towel. Cold compresses to the upper body, head, neck, and groin will help cool the victim. A fan may be used to aid in evaporation of the water (evaporative method). Ice and very cold water can produce hypothermia; they should be used only when there are means to monitor the victim's temperature continuously.

Immersing a victim into a bathtub of cold water (immersion method) is a recognized method of cooling. This should be avoided for an unconscious victim; if there is no alternative, the victim's head must be held above water.

Hydration is of paramount importance in cooling the victim. This is achieved by drinking water (Oral rehydration). Commercial isotonic drinks may be used as a substitute. Alcohol and caffeine should be avoided, because of their diuretic properties. Some authorities are opposed to giving any fluids, except by emergency personnel. If the victim is confused, unconscious or unable to tolerate oral fluids, intravenous hydration (via a drip) is necessary. Alcohol rubs will cause further dehydration and impairment of consciousness and should therefore be avoided. The victim's condition should be reassessed and stabilized by trained medical personnel. The victim's heart rate and breathing should be monitored, and CPR may be necessary if the victim goes into cardiac arrest. The victim should be placed into the recovery position to ensure that their airway remains open.