How to recognize / deal with hypothermia or cold exhaustion

What is hypothermia

Hypothermia is defined as any body temperature below 35.0 °C. Normal body temperature in humans is 36.5 – 37.5°C which is required to maintain normal metabolism and body functions. In humans core body temperature is maintained near this constant level, however when the body is exposed to cold, its internal mechanisms may be unable to replenish the heat that is being lost to the surroundings.

It is subdivided into four different degrees:

mild (32 - 35ºC)
moderate (28 - 32ºC)
severe (20 - 28ºC)
profound (less than 20ºC)

It is usually caused by being in a cold environment and although the British Isles have a relatively mild climate the combination of wind and wet weather that frequently prevail in wild places can quickly bring on hypothermia. It can be triggered by a combination of things including rain, wind, sweat, inactivity or being in cold water. If you are exhausted, hungry or injured you will suffer reduced resilience to the environment and remember that smaller people are more at risk than bigger ones!

When your body gets cold, the normal response is to warm up by becoming more active, putting on more layers or moving indoors. But if exposure to the cold continues, your body's automatic defence system will try to prevent any further heat loss by:

- shivering (which keeps the major organs at normal temperature),
- restricting blood flow to the skin, and
- releasing hormones to generate heat.

After prolonged exposure to the cold, these responses are not enough to maintain body temperature, as they also drain energy. The casualty becomes more exhausted and more susceptible to hypothermia.

Conditions Leading to Hypothermia

- Cold temperatures
- Improper clothing and equipment
- Wetness
- Fatigue, exhaustion
- Dehydration
- Poor food intake
- No knowledge of hypothermia
- Alcohol intake - causes vasodilation leading to increased heat loss

Prevention

Appropriate clothing helps to prevent hypothermia. Wearing cotton in chilly weather is a particular hypothermia risk as it retains water, and water quickly conducts heat away from the body. Even in dry weather, cotton clothing can become damp from perspiration, and chilly after the wearer stops exercising. Synthetic and wool fabrics provide far better insulation when wet and dry more quickly. Damp clothing caused by sweat whilst active can be significantly reduced by wearing wicking under clothing that transports moisture away from the bodies surface before evaporation occurs. Layering clothing is important and allows the wearer to balance the outside temperature with the amount of energy expenditure. Setting an appropriate pace allows a group to minimize perspiration especially when walking uphill.

Heat loss on land is very difficult to predict due to multiple variables such as clothing type and quantity, amount of insulating fat on the victim, environmental humidity or personal dampness such as after exertion, the circumstances surrounding the hypothermic episode, and so on. Heat is lost much faster in water, hence the need for wetsuits or drysuits in cold-weather activities such as kayaking. Water temperatures that would be quite reasonable as outdoor air temperatures can lead to hypothermia very quickly. For example, a water temperature of 10 °C can be expected to lead to death in approximately 1 hour, and water temperatures hovering at freezing can lead to death in as little as 15 minutes. On the other end of the scale, in water even a temperature as high as 26 °C may eventually (after many hours) lead to mild hypothermia.

Alcohol consumption prior to cold exposure may increase one's risk of becoming hypothermic. Alcohol acts as a vasodilator, increasing blood flow to the body's extremities, thereby increasing heat loss. Ironically, this may cause the victim to *feel* warm while rapidly losing heat to the surrounding environment.

Signs & Symptoms

Mild hypothermia - Body temperature drops by 1–2 °C below normal temperature (down to 35–37 °C). Mild to strong shivering occurs. The victim is unable to perform complex tasks with the hands; the hands become numb. Blood vessels in the outer extremities constrict, 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 (which is of limited use in humans due to lack of sufficient hair, but useful in other species). Victim may feel sick to their stomach, and very tired. Often, a person will experience a warm sensation, as if they have recovered, but they are in fact heading into Stage 2. Another test to see if the person is entering stage 2 is if they are unable to touch their thumb with their little finger; this is the first stage of muscles not working. They might start to have trouble seeing.

Moderate hypothermia - Body temperature drops by 2–4 °C below normal temperature (33–35 °C). Shivering becomes more violent. Muscle mis-coordination 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. The victim becomes pale. Lips, ears, fingers and toes may become blue.

Severe hypothermia - Body temperature drops below approximately 32 °C. Shivering occurs in waves, violent then pause, pauses get longer until shivering finally ceases - because the heat output from burning glycogen in the muscles is not sufficient to counteract the continually dropping core temperature, the body shuts down on shivering to conserve glucose. Person falls to the ground, can't walk, curls up into a fetal position to conserve heat. Muscle rigidity develops - because peripheral blood flow is reduced and due to lactic acid and CO2 buildup in the muscles. Skin is pale, pupils dilate and pulse rate decreases, but fast heart rate can occur. Difficulty speaking, sluggish thinking, and amnesia start to appear; inability to use hands and stumbling is also usually present. Cellular metabolic processes shut down. Below 30 °C, the exposed skin becomes blue and puffy, muscle coordination becomes very poor, walking becomes almost impossible, and the victim exhibits incoherent/irrational behavior or even a stupor. 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. Twenty to fifty percent of hypothermal deaths are associated with a phenomenon known as paradoxical undressing. This typically occurs during moderate to severe hypothermia, as the victim becomes disoriented, confused, and combative. The hypothermic victim may begin discarding their clothing, which, in turn, increases the rate of heat loss. There have been several published case studies of victims throwing off their clothes before help reached them. Rescuers that are trained in mountain survival techniques have been taught to expect this effect.

How to Assess if someone is Hypothermic

- If shivering can be stopped voluntarily = mild hypothermia
- Ask the person a question that requires higher reasoning in the brain (count backwards from 100 by 9's). If the person is hypothermic, they won't be able to do it.
- If shivering cannot be stopped voluntarily = moderate - severe hypothermia
- If you can't get a radial pulse at the wrist it indicates a core temp below 90 - 86 degrees

The person may be curled up in a fetal position. Try to open their arm up from the fetal position, if it curls back up, the person is alive. Dead muscles won't contract only live muscles.

Moderate and severe cases of hypothermia require immediate hospitalization. In a hospital, external treatments, such as heated blankets are used to warm patients with mild hypothermia, as well as internal treatments such as injected warm fluids.

Treating Hypothermia

The basic principles of re-warming a hypothermic victim are to conserve the heat they have and replace the body fuel they are burning up to generate that heat. If a person is shivering, they have the ability to re-warm themselves at a rate of 2 degrees centigrade per hour.

Mild - Moderate Hypothermia

Reduce Heat Loss with:

Additional layers of dry clothing
Increased physical activity
Shelter

Waterproofs, spare clothing, hats and gloves will all make a significant difference. If adequate shelter is not available it is safer to place insulating clothing over the wet clothing instead of removing the wet clothing.

It is essential to keep a hypothermic person adequately hydrated and fueled.

Food types

- Carbohydrates quickly released into blood stream for sudden brief heat surge - these are the best to use for quick energy intake especially for mild cases of hypothermia
- Proteins - slowly released - heat given off over a longer period
- Fats - slowly released but are good because they release heat over a long period, however, it takes more energy to break fats down into glucose - also takes more water to break down fats leading to increased fluid loss

A warm drink can be a great morale booster and any calorie content will be useful in helping to fight hypothermia. Drink should never be poured into an unconscious casualties mouth as this would cause drowning.

Things to avoid

- Alcohol - a vasodilator - increases peripheral heat loss
- Caffeine - a diuretic - causes water loss increasing dehydration
- Tobacco/nicotine - a vasoconstrictor, increases risk of frostbite

Add Heat

- Fire or other external heat source
- Body to body contact. Get into a sleeping back, in dry clothing with a normothermic person in lightweight dry clothing

Severe Hypothermia

Reduce heat loss by wrapping the person in the thickest layers of insulation that you can, preferably to around ten centimeters all round. Especially protect from the ground. The person must be protected from any moisture in the environment. No matter how cold, patients can still internally re-warm themselves much more efficiently than any external re-warming. Include an aluminum "space" blanket if one is available to help prevent radiant heat loss, and wrap the entire ensemble in plastic to protect from wind and water. If someone is truly hypothermic, don't put him/her naked in a sleeping bag with another person.

It may become virtually impossible to detect signs of life, but one should never presume death. Provide plenty of insulation and request rescue assistance urgently.

For people in severe hypothermia, the stomach has shut down and will not digest solid food but can absorb water and sugars. Give a dilute mixture of warm water with sugar every 15 minutes.

The patient will need to urinate and will need help to do this. A full bladder results in body heat being used to keep urine warm rather than vital organs so urinating will ultimately help to keep the person warmer.

Heat can be applied to transfer heat to major arteries - at the neck for the carotid, at the armpits for the brachial, at the groin for the femoral, at the palms of the hands for the arterial arch.

- Chemical heat packs provides 110 degrees F for 6-10 hours.
- Hot water bottles, warm rocks, towels, compresses
- For a severely hypothermic person, rescue breathing can increase oxygen and provide internal heat.

Afterdrop

Is a situation in which the core temperature actually decreases during rewarming. This is caused by peripheral vessels in the arms and legs dilating if they are rewarmed. This dilation sends this very cold, stagnate blood from the periphery to the core further decreasing core temperature which can lead to death. In addition, this blood also is very acetic which may lead to cardiac arrythmias and death. Afterdrop can best be avoided by not rewarming the periphery. Rewarm the core only! Do not expose a severely hypothermic victim to extremes of heat.