MOUNTAIN HYPOTHERMIA

Hypothermia is commonly defined as 'a decrease in core temperature to a level at which normal muscular and cerebral functions are impaired'. Core temperature refers to the 'vital organ' core of the body - the trunk and the head. Under normal circumstances the core temperature will be within one degree of 37 degrees C.

There are three types of hypothermia. The acute form happens when cold stress is so great and sudden that the body's resistance to cold is quickly over-ridden, as happens when a fisherman falls into the North Sea. Chronic hypothermia occurs when an elderly or infirm person is unable or unwilling to heat their surroundings adequately, and becomes less active as their temperature decreases. The third, sub-acute hypothermia is the type experienced by hillwalkers and mountaineers, and is characterised by exhaustion i.e. depletion of the body's energy stores. This article is concerned with mountain hypothermia only, and attempts to provide the reader with a greater understanding of the condition, and so be better able to recognise, prevent and manage it.

The body loses heat in four ways. Convection is the transfer of heat energy from the person to the air and is greatly increased by air movement (wind-chill). Radiation can be considerable in cold conditions if the skin is not covered and insulated. Conduction involves the loss of heat by transfer. It particularly applies to mountain casualties who are often lying down, so have a large surface area in contact with the ground. Evaporation occurs as sweat produced during exertion cools the body.

When cold, the body attempts to maintain heat by the following means. Shivering is an involuntary response by skeletal muscles to cold exposure. It increases muscle tone and metabolism, which may increase oxygen consumption. If cold exposure continues, considerable glycogen (energy) stores are used up with consequent water loss. Cold causes the small blood vessels in the skin to contract. This reduces blood flow to the skin and the extremities (hands and feet), which helps to maintain core temperature and minimise further heat loss. Body fat just under the skin has few blood vessels so is a poor conductor of heat. The more fat the better the insulation. Some of the body stores of fat can be activated to provide energy.

Heat production can be increased by conscious effort. Physical activity produces more body heat, but may not be an option in exhaustion or when injured. Eating and drinking help to increase body temperature by providing energy.

A person's ability to regulate body temperature can be impaired in several ways. Exhaustion reduces heat production, and food intake not only offsets that but also leads to a spurt of heat production during the ensuing digestive process. Trauma and loss of blood increase heat loss. Sleep decreases the basal metabolic rate by as much as 9% therefore lowering heat production.

This is why mountaineers bivouacking in extreme conditions, should keep each other awake to conserve heat. Alcohol can precipitate hypothermia in cold environments, due to an increase in blood flow to the skin and an associated decrease in blood glucose levels. The depressant effect of alcohol can also reduce the ability of climbers to assess danger, and leave them open to the risk of hypothermia and other potentially fatal situations.

There are two main factors involved in mountain hypothermia, environmental and individual.

Environmental factors

Low air temperature and high wind speed generate severe cooling effects often referred to as wind-chill. For any given air temperature the wind-chill factor increases rapidly with increases in wind speed. Even small changes in relatively low wind speeds have a significant effect on the level of cooling. Humid air is more effective in transposing heat from the body than dry air; the 'damp cold' of everyday speech has a real physical basis. Clothing loses a lot of its insulating efficiency when wet because the insulation (the barrier to heat loss) derives from pockets of static air trapped in the texture.

Individual factors

Clothing needs to be able to combat wind-chill and wet cold and therefore should be water and windproof. It should also be breathable to minimise internal condensation caused by sweating. Head covering is particularly important, and up to 70% of total heat production at -15 degrees C has been shown to be lost through the head. Failing to eat enough food to replace the energy used in heavy exercise renders the body unable to mobilise energy reserves to do further work, and generate heat to maintain a normal core body temperature. Dehydration is seriously under-rated. It leads to a decrease in physical and mental efficiency, lower resistance to exposure and significantly contributes to hypothermia . Walking in cold conditions causes the body to lose a lot of water through the humid air expired from the lungs. In high altitude climbing and polar travel, the problem of obtaining sufficient drinking water to offset this insidious water loss is a major practical problem. Females can tolerate exposure better than males due to their generally thicker layer of fat under the skin. However this may be offset by the capacity of males to expend greater levels of energy and thus produce more heat. The small bodies of children are particularly at risk, as are tall, lean men with a large surface area and little body fat.

Signs and symptoms of hypothermia

Most hillwalkers will feel cold and tired at times. It would be foolish to regard everyone in this situation as having hypothermia. These common complaints should however, alert other team members to look out for further symptoms associated with hypothermia. These include skin numbness,

shivering, cramps, a slow, stumbling pace, slurred speech, poor decision making, irrational behaviour and in advanced cases, muscular rigidity. The following table indicates how these may develop as core temperature decreases.

Core temperature	Signs and symptoms
37 to 36 degrees C	Normal temperature range. shivering may begin.
36 to 35 degrees C	Cold sensation, goose pimples. Unable to perform complex tasks. Mild to severe shivering.
35 to 34 degrees C	Intense shivering. Movement becomes slow and laboured. Mild confusion, stumbling pace.
34 to 32 degrees C	Violent shivering. Difficulty in speaking. Muscle movement becomes sluggish. Unable to use hands.
32 to 30 degrees C	Shivering stops. Confused and incoherent. Irrational behaviour. Onset of chronic hypothermia.
30 to 27 degrees C	Muscles become rigid. Pulse and respiration rate slows. Semiconscious.
27 to 25 degrees C	Unconscious. Heart beat becomes erratic. Tendon reflexes stop.
25 to 24 degrees C	Failure of cardiac and respiratory centres. Death.

Prevention and management of hypothermia

Prevention is largely good planning and preparation. Make sure that you are adequately clad, eat little and often, drink plenty and stop before you become exhausted. If problems occur, seek shelter, conserve body heat and stay out of the wind.

Hypothermia in the mountains is quite common, and should be anticipated if you have a casualty to care for. Provide what shelter you can, out of the wind, rain or worse. Insulate him from the ground and provide him with