Altitude Related Illnesses

Adapted from the MERCK manual

Altitude illness occurs because of a lack of oxygen at high altitudes.

As altitude increases, the atmospheric pressure decreases, thinning the air so that less oxygen is available. For example, compared with the air at sea level, the air on Giants Castle peak (about 3 000 meters above sea level), has about 30% less oxygen; and the air near the top of Mount Everest (more than 8 000 meters above sea level), about 66% less oxygen.

Altitude illness occurs when an oxygen deficiency at high altitudes causes fluid in the blood to leak from the smallest blood vessels (capillaries) into the surrounding tissues, resulting in swelling (oedema). The forms of altitude illness differ mainly in their degree of severity and where in the body the fluid accumulates. Mild fluid accumulation in the brain causes acute mountain sickness (AMS), whereas more severe fluid accumulation in the brain causes high-altitude cerebral oedema (HAPO). Fluid accumulation in the lungs causes high-altitude pulmonary oedema (HAPO). Fluid accumulation in the hands, feet, and face causes high-altitude oedema. This is seen by almost all hikers and climbers in the first day of a trip to altitude and is commonly blamed on water retention.

Altitude illness is common in people visiting high altitudes. The severity of the illness depends on how high and how quickly a person ascends. For example, most people who, within a day or two, ascend to above 1800 meters develop high-altitude oedema. AMS develops in 10% of people who ascend too rapidly above 2400 meters, in 25% of people above 2700 meters, and in almost 50% of people above 4200 meters. HAPO and HACO rarely develop at altitudes below 3000 meters.

People who normally live at sea level or at very low altitudes are more likely to be affected by altitude illness, as are those who engage in strenuous exertion soon after ascent. People with certain lung diseases (such as chronic obstructive pulmonary disease), heart and blood vessel disorders (such as angina, heart failure, or peripheral vascular disease), or blood disorders (such as sickle cell anaemia or haemoglobin S-C disease) may have particular difficulties at high altitudes. Asthma, however, does not seem to be worse at high altitudes. Spending less than a few weeks at altitudes below 3000 meters does not appear to be dangerous for a pregnant woman or the foetus. Physical fitness has no effect on a person's risk of developing altitude illness. Fewer older people than young people develop altitude illness. People who have had HAPE and HACE previously are particularly likely to develop those conditions again after ascent.

The body eventually adjusts (acclimatises) to higher altitudes by increasing respiration and heart activity and by producing more red blood cells to carry oxygen to the tissues. Most people can adjust to altitudes of up to 3000 meters in a few days. Adjusting to much higher altitudes takes many days or weeks, but some people can eventually carry out normal activities at altitudes above 5 300 meters.

Symptoms and Diagnosis

Acute Mountain Sickness (AMS) is a mild form of altitude illness. Symptoms usually develop within 4 to 12 hours of ascent and include **headache**, **light-headedness**, and, particularly with exercise, **shortness of breath**. **Loss of appetite** and **nausea** and **vomiting** may follow, along with **fatigue**, **weakness**, and **irritability**. Some people describe the symptoms as similar to those of a hangover. People who stay overnight at a high altitude may have trouble sleeping. Symptoms usually last 24 to 36 hours. However, acute mountain sickness may progress to more severe forms of altitude illness.

High-altitude oedema causes swelling of the hands, the feet, and, on awakening, the face. The swelling causes little discomfort and usually subsides in a few days.

High-Altitude Pulmonary Oedema (HAPO) may progress from a mild illness to a life-threatening one within a few hours. Symptoms often develop during the second night after ascent, are worse at night, and can become progressively more severe. Mild symptoms usually include a **dry cough** and **shortness of breath** after only mild exertion. Moderate symptoms include shortness of breath at rest; **confusion**; **pink or bloody sputum**; **low-grade fever**; and a **bluish tinge to the skin**, **lips, and nails** (cyanosis). Severe symptoms include **gasping for breath** and making **gurgling sounds** while breathing.

High-Altitude Cerebral Oedema (HACO) is present in a mild form in other types of altitude illness but may become severe. It causes **headache**, **confusion**, walking that is **unsteady and uncoordinated** (ataxia), and **coma**. These symptoms may progress rapidly from mild to life-threatening within a few hours.
A doctor diagnoses altitude illness based mainly on the symptoms. In high-altitude pulmonary oedema, fluid can sometimes be heard in the lungs through a stethoscope. An x-ray of the chest and measurement of the amount of oxygen in the blood can help confirm the diagnosis.

Treatment

People with acute mountain sickness must stop their ascent and rest. They should not ascend to higher altitudes until symptoms disappear. Most people with acute mountain sickness improve within a day or two. Acetazolamide or corticosteroids, such as dexamethasone, may help relieve symptoms. Acetaminophen or no steroidal anti-inflammatory drugs help relieve headache. However it is unwise to continue ascent whilst using drugs to alive symptoms.

If symptoms are more severe, supplemental oxygen should be provided through a face mask. If supplemental oxygen is unavailable, however, or if symptoms persist or worsen despite treatment, the person should descend to a lower altitude, preferably at least 800 meters lower.

If high-altitude oedema is troublesome, diuretics, such as hydrochlorothiazide, can be helpful. However, the swelling resolves after descent,

regardless of treatment.

People with high-altitude pulmonary oedema should receive oxygen and, if there is no rapid improvement, descend as soon as possible. However, unnecessary exertion should be avoided, because it increases the body's need for oxygen, thus worsening symptoms of high-altitude pulmonary oedema. Therefore, the person should be carried to a lower altitude, if possible, and kept warm. The drug nifedipine may temporarily help by decreasing blood pressure in the arteries to the lungs.

If high-altitude cerebral, oedema develops, the person should descend as far down and as soon as possible. Supplemental oxygen and dexamethasone should be given.

When prompt descent to a lower altitude is not possible, a hyperbaric bag can be used. This device, which consists of a lightweight, portable fabric bag or tent and a manually operated pump, simulates an increase in atmospheric pressure. The person is placed in the bag, which is then tightly sealed. The bag's internal pressure is then increased with the pump. The person remains in the bag for 2 or 3 hours. The hyperbaric bag is as beneficial as supplemental oxygen, which often is not available when mountain climbing.

Prevention

The best way to prevent altitude illness is to ascend slowly, taking 2 days to reach 2400 meters and another day for each 300 to 600 additional meters. The altitude at which a person sleeps is more important than the maximum height reached during the day. The pace of ascent should be slowed if symptoms of altitude illness develop.

Avoiding strenuous exertion for a day two after arrival may prevent altitude illness as may eating frequent, small high-carbohydrate meals instead of fewer large meals, and drinking at least 3 litres of non-caffeinated fluids per day. Alcohol and sedatives, which can cause symptoms similar to acute mountain sickness, should be avoided.
Athletes residing at sea level can take certain steps to prepare for competitions held at high altitudes. For brief, high-intensity competitions such as sprints or jumps. For example, performance is best if the person arrives less than 1 day before the event. For endurance competitions, performance is best if for several weeks beforehand the person trains at low altitudes but sleeps at high altitudes.

Other Illnesses that Develop at High Altitudes

Some illnesses develop at high altitudes for reasons unrelated to the fluid accumulation that causes altitude illness.

High-Altitude Retinal Haemorrhages (small areas of bleeding in the retina at the back of the eye) may develop after ascent to altitudes of 2400 meters or higher. Retinal haemorrhages rarely produce symptoms. However, if a haemorrhage occurs in the part of the eye that is responsible for central vision (the macula), the person may notice a small blind spot. High-altitude retinal haemorrhages resolve after 1 or 2 weeks without treatment. If haemorrhage involves the macula, the person should descend.

Snow Blindness, which is sunburn of the eye, often develops at high altitudes even if there is no snow. Ultraviolet (UV) light becomes about 5% stronger every 300 meters above sea level.

Reflection from the snow makes the light even more intense. Even on cloudy days, strong UV light burns the eye. Symptoms of snow blindness develop 6 to 12 hours after a burn is sustained. The eye becomes painful, red, swollen, and sensitive to light and feels gritty. Analgesics, cool compresses, and eye patches usually help. Anaesthetic drops should not be used; instead, a drop of mineral oil may relieve pain. Symptoms disappear within about 24 hours. To prevent snow blindness, strong sunglasses with side shields should be worn.

High-Altitude Pharyngitis and **bronchitis** often develop at altitudes higher than 3000 meters. The dry, cold air irritates the throat and lungs, causing a sore throat and a hacking cough. The cough can become severe enough to fracture ribs. Drinking a lot of fluids and increasing salivation by sucking hard sweets can relieve symptoms. Masks made of silk or similar materials may also help by (trapping moist, hot exhaled air within the mouth and nose. Antibiotics rarely help. Chronic mountain sickness (Monge's disease) is an uncommon illness that develops in some people who live at altitudes higher than 3 600 meters for many months or years. In these people, the body overcompensates for the lack of oxygen by overproducing red blood cells. The extra red blood cells make the blood so thick that it cannot pass easily through small blood vessels. Symptoms include headache, muddled thinking, difficulty sleeping, drowsiness, aches and pains, and shortness of breath. Blood clots may form in the legs and lungs, and the heart may become unable to pump enough blood. Periodic removal of a pint of blood (phlebotomy) provides temporary relief, but the only effective treatment is descent, to sea level. Complete recovery can take months.

For more information about mountain skills training contact:

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or

Any of the trainers listed on the MDT website

Errors, corrections or suggestions for improvements for this training sheet may be forwarded to:

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