



## High Altitude Notes

### Impact of High Altitude on the Human Body and Brain

- As altitude increases, barometric pressure (a measure of the “weight” of the air) reduces.
- At 19,000ft barometric pressure is half that at sea level.
- As a direct result of this fall in pressure, oxygenation decreases.
- In July/August atmospheric pressure is universally higher than at other times of the year.
- It is therefore better to be climbing at the equator in midsummer.

Altitude illness (mountain sickness) includes several syndromes, including acute mountain sickness (AMS), Hypoxia, chronic mountain sickness, high altitude pulmonary oedema (HAPE), high altitude cerebral oedema (HACE), and high altitude retinal haemorrhage (HARH). Well over 50% of travellers develop some form of AMS at 3500m, but almost all do so if they ascend rapidly to 5000m (16,400 ft). Less than 2% of travellers contract HAPE. HACE is a relative rarity.

The exact cause of altitude sickness is controversial; however the following points represent a popular hypothesis:

**HYPOXIA** Causing Hyperventilation, headaches, undue breathlessness, the sensation of the heart beating forcibly, loss of appetite, nausea, vomiting, dizziness, difficulty sleeping and irregular breathing during sleep (AMS) and may lead to:

**HAPE** Vasoconstriction in the lung, resulting in increased pressure which can cause leaks in the capillaries leading to oedema. Signs and symptoms (some similar to AMS) demand immediate descent or death may result. They include: breathlessness on exertion and at rest, cough, gurgling in the chest, blood in sputum, decreased exercise tolerance, intermittent shortness of breath, chest tightness (often worse at night), increased heart and respiratory rate, cyanosis of lips or extremities, crackling in lungs may be heard (rales). One of the first symptoms is more than average breathlessness on climbing, followed by breathlessness at rest, often accompanied by a cough. A dry cough however is also common at altitude and in most cases is not due to HAPE. Immediate descent required, and if possible drug regime of Nifedipine 20mg by mouth, 10mg of which should be crushed and placed under tongue immediately. Then administer 20mg 6 hourly for 24 hours.

**HACE** Capillaries in the brain leak fluid causing brain swelling. Usually occurs only above 12,000ft and after rapid ascent. Symptoms generally but not always seem like those of AMS but the headache is severe and not relieved by analgesics. Further symptoms may include: vertigo, ataxia - unsteady movements and balance - and hallucinations. As ataxia is one of the first symptoms usually to appear, it is worth doing a heel to toe walking test. Treatment is descent and more descent. Drug regime of Dexamethasone may help (8mg by mouth initially, then 4mg 6 hourly for 24 hours).

### Further Conditions associated with High Altitude

**High Altitude Retinal Haemorrhages** (minute blood blisters at the back of the eye) are common around 5000m but very rarely cause any problems but, if they appear to enlarge, descent is advised.

**Sleep** may deteriorate with hypoxia (lowering of oxygen content). However you should remember that an 8 hours sleepless night lying at rest is the equivalent of 6 hours sleep, so do not become distressed about lack of sleep.

**Dehydration** is possible and liquid intake should be kept up. But there is no evidence that lots of liquid prevents AMS. Hypoxia stimulates a urine flow. AMS usually leads to a reduced urine output. The conclusion seems to be: “drink more than usual, but not to the point of nausea”.

The **skin** at altitude is at risk from the increased UV, the cold and the wind. Symptoms include; ageing, sunburn, cold sores, prickly heat, and UV conjunctivitis. Your kit should contain high factor sunscreen and lipsalve with sunblock.

**Peripheral Oedema** or the swelling of hands and feet due to fluid retention is sometimes noted at altitude, especially after a long hike. The symptoms usually diminish after a few days, and they do not necessarily herald HACE or HAPE.

Mild **Hypothermia** arises when the body core temperature is caused to drop to between 32-35°C. Symptoms include shivering, stumbling and poor co-ordination. Treatment includes: warm dry clothes, warm packs, and plenty to drink - preferably warm liquids. Below 32°C is considered to be severe hypothermia and when the core temp falls below 30°C shivering will cease. The patient must be disturbed as little as possible, insulated with warm items such as a sleeping bag; and very gently taken to a lower altitude. This is a very serious condition requiring skilled medical attention.

**Heat Exhaustion and Heat Stroke** can arise in mountain terrain as well as lowland hot zones. Temperatures at altitudes of over 20,000ft (6,000m) can reach 30°C in the sun. Heat Exhaustion is the result of salt and water loss through sweating accompanied by low oral intake of fluids. Symptoms are profuse sweating, dizziness, and fatigue. Treatment consists of removing the patient from the sun, fanning or cool sponging, and oral rehydration. Heat Stroke is a potentially fatal condition and differs from heat exhaustion in that the body temperature rises above 40°C, sweating may cease, the body will be very hot to touch, headache is likely, and mental disturbance. Urgent treatment to remove the patient from the sun, surface cool the body with cool liquid and fanning, followed by evacuation to hospital.

### **Oral Contraceptives (OC's) and High Altitude**

"There is cumulative evidence of very many women who have taken OC's on trekking and climbing holidays both in the Alps and at higher altitudes, with no particular unwanted effects noted regularly. Vomiting if suffering from AMS might reduce the efficacy of an OC". Dr Charles Clarke FRCP - October 2002

## **PREVENTION AND REDUCTION OF AMS:**

To avoid these conditions we need to acclimatise to the increasing altitude by climbing slowly. AMS need not lead to the abandonment of a climb. If the symptoms are mild, a rest day at the same or a lower altitude may be sufficient. However if the symptoms persist the climber must descend. Otherwise there is the real risk that the illness will develop into the more serious and life-threatening HAPE or HACE.

### **DIAMOX**

Our itineraries are designed to acclimatise you to altitude without the need for Diamox (acetazolamide). Diamox, a drug often used in the treatment of the eye condition glaucoma can also be useful in the prevention of Acute Mountain Sickness (AMS) by reducing fluid retention (it makes you urinate) and stimulating faster and deeper breathing in sleep. Diamox can reduce the headaches associated with AMS (which can be a hindrance as it masks the symptoms of AMS) but can also help the body acclimatise to the lack of oxygen. Whether or not one takes Diamox is obviously a matter of personal choice - travel to high altitudes is quite possible without it. Subject to the essential approval from your doctor, it is a personal decision as to whether to take the drug or not. NB Diamox is a sulfonamide medication, and persons allergic to sulfa medicines should not take it.

**Taking Diamox:** If a personal choice is made to take Diamox, then it is advised that 250mg (one tablet) is taken twice daily as a trial at sea level for two days several weeks before a visit to altitude. Assuming no unpleasant side effects are experienced, take the drug in the same dose for 3 days before ascent to 3500m (or more), and for two more days, i.e. five days in all.

**Side Effects:** Like all drugs, Diamox may have unwanted side effects. Tingling of the fingers, face and feet is the commonest, but this is not a reason for stopping the drug unless the symptoms are intolerable. Dizziness, vomiting, drowsiness, confusion, rashes and more serious allergic reactions have all been reported but are unusual. In exceptional cases, the drug has caused more serious problems with blood formation and/or the kidneys. Those who are allergic to the sulphonamide antibiotics may also be allergic to Diamox. More commonly, the drug makes many people feel a little "off colour"; fizzy drinks also taste strange when you are taking Diamox.

### **Bibliography for Mountain Health:**

"Expedition Medicine" published by the Royal Geographical Society

"High Altitude Medicine Handbook" by Andrew Pollard and David Murdoch. Published by Radcliffe Medical Press.

UIAA Mountain Medicine Centre Information Sheets

High Altitude Medicine Guide - Altitude Illness Clinical Guide for Physicians

**Acknowledgements:** *These notes were compiled with the help of information from The Institute of Mountain Medicine, The High Altitude Medicine Guide, The UIAA Mountain Medicine Centre Information Sheets, the High Altitude Medicine Guide and guidance notes from Dr. Charles Clarke FRCP for the British Mountaineering Council.*