26 HIGH-ALTITUDE AND MOUNTAINEERING EXPEDITIONS

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A number of related medical conditions develop when people travel to altitudes above 3,000m (10,500ft). There is a wide variation in both the speed of onset and severity of symptoms and also the height at which they develop. The problems are caused by lack of oxygen.

In Nepal, the country with most high-altitude visitors (probably over 50,000 per year), the mortality rate of trekkers is believed to be around seven per year, with a quarter of the deaths due to altitude-related illness. In other words, several people on holiday die each year from potentially treatable conditions. On high-altitude climbing expeditions to peaks over 7,000m death rates are much higher, at around 4%. It is difficult to ascertain the importance of altitude illness compared with accident. In practical terms, for the expedition organiser or doctor, on a trip to heights over 5,000m, illness due to lack of oxygen demands recognition, chiefly because it is an unpleasant hindrance, but also, rarely, because it is a cause of fatalities.

MEDICAL PROBLEMS SPECIFIC TO HIGH ALTITUDE

Acute mountain sickness

Most people feel unwell if they drive, fly or travel by train from sea level to 3,000–3,500m. Headache, fatigue, undue breathlessness on exertion, the sensation of the heart beating forcibly, loss of appetite, nausea, vomiting, dizziness, difficulty sleeping and irregular breathing during sleep are the common complaints. Shivering and feeling the cold are also common. These are symptoms of acute mountain sickness (AMS), which usually develop during the first 36 hours at altitude and not immediately on arrival. The symptoms pass after several days.

Well over 50% of travellers develop some form of AMS at 3,500m, but almost all do so if they ascend rapidly to 5,000m (16,400ft). On a personal level I feel unpleasantly exhausted and headachy for several days every time I fly to Lhasa, which is at 3,620m – this is the usual situation for most people.

Figure 26.1 *Sepu Kangri, 4,700m, eastern Tibet, May 1997. Serious altitude sickness is a problem at these altitudes, despite the gentle terrain of base camp (C. Bonington, Chris Bonington Picture Library)*

Acclimatisation and ascent profiles

Acclimatisation, i.e. feeling well again, takes place over several days. Once travellers are acclimatised in this way, further gradual height gain can take place although symptoms may recur. Acclimatisation to, say, 4,000m, allows the body to adapt to this altitude, but not higher until further acclimatisation has taken place.

The question "How high, how fast?" has no absolute answer because of individual variation, but it is reasonable for healthy people of any age to travel rapidly to 3,500m. One often has to fly to this sort of altitude (Lhasa, for example, is 3,620m). Many people will develop AMS after arrival. It is unwise to travel much above 3,500m immediately from sea level. Accepted guidelines for Himalayan trekking groups (rarely adhered to in practice) are 300m of height gain per day above 3,000m with a rest day every third day. This profile seems tiresomely slow for many but it is well worth advocating – many altitude-related incidents occur in large groups where the slow acclimatiser is swept along by fitter members. By endorsing this profile would-be trekkers can encourage their trekking agent/team leader to adopt a safe schedule before departure – and make a journey at high altitude more enjoyable.

Above 4,000m the speed of further height gain should continue to be gradual and it is advisable to spend a week above 4,000m before sleeping above 5,000m.

The highest altitude where humans live permanently is about 5,500m (18,000ft), but on mountaineering expeditions or treks, residence for several weeks around 6,000m (20,000ft) is quite possible. At these altitudes people who are acclimatised should feel entirely well, being limited only by breathlessness on exertion. It is often impossible (for example on the Tibetan plateau) to keep to this counsel of perfection.

Prediction and prevention of AMS

There is unfortunately no way of predicting who will be seriously troubled by AMS and who will escape it. It is tempting to suppose that being physically fit and avoiding smoking would help in prevention, but unfortunately this is not so. Strenuous exercise at altitude, whether or not the subject is fit, makes AMS worse. Undue exertion and carrying heavy loads should therefore be avoided until acclimatised.

Patients with heart or lung disease or high blood pressure should seek specialist advice before travelling above 3,500m. Occasionally an individual develops AMS on every occasion they go to altitude.

Prevention of AMS

- Graded ascent (see above)
- Consider acetazolamide (Diamox) 125mg (half a 250mg tablet) twice a day.

Graded ascent is the best preventer of AMS. However, there has been much research on acetazolamide (Diamox), a drug used to reduce fluid retention (it makes you urinate) and in the treatment of glaucoma. Diamox also stimulates respiration – and this is probably why it is helpful. There is no doubt that Diamox is genuinely useful in the prevention of AMS if taken for several days before ascent. If Diamox is being used, half of one 250mg tablet should be given twice daily for 3 days before 3,500–5,000 metres is reached.

Travellers who take Diamox should be aware of its unwanted effects (all drugs have their dangers). Diamox makes some people feel nauseated and generally unwell and quite commonly causes tingling of the fingers. These cease when the drug is stopped. More unusual reported side-effects include flushing, rashes, thirst, drowsiness or excitement. People who are allergic to sulphonamide antibiotics are likely to develop allergic reactions to Diamox (e.g. rashes).

I do not recommend the drug routinely, and do not take it myself. If someone wants to take Diamox (e.g. because of previous problems) I suggest a trial of Diamox at sea level (i.e. before leaving home) for 2 days, so that its effects are known to the individual.

Treatment of AMS
It is important to emphasise that AMS, although unpleasant, is usually a self-limiting condition without serious sequelae. Principles of treatment include:

- Rest days, relaxation, descent? Do not go higher!
- Simple analgesia for headache: aspirin, paracetamol
- Consider dexamethasone 4mg every 4 hours (three doses)
- Consider hyperbaric chamber (portable pressure bag).

Portable pressure bags (hyperbaric chambers) are of some value in buying time while plans for descent are under way. They are, however, bulky (the size of a small rubber dinghy).

I use no drugs unless really necessary because symptoms usually resolve; the only real cure is to become acclimatised to the lack of oxygen. It is most important not to go higher if symptoms develop and to consider losing altitude if recovery does not take place within several days – and certainly if symptoms worsen.

Pulmonary and cerebral oedema: severe forms of AMS
In less than 2% of travellers AMS occurs in several serious forms at 4,000–5,000m and occasionally lower.

High-altitude pulmonary oedema
This is a condition in which fluid accumulates in the lung causing severe illness (which may come on in minutes). It is characterised by breathlessness and sometimes frothy sputum (phlegm). Early pulmonary oedema should be suspected if a member of a party is unduly short of breath (certainly at rest) or if they have a persistent dry cough or apparent chest infection causing breathlessness. Pulmonary oedema may be preceded by AMS.

Prevention of high-altitude pulmonary oedema

- Ascend slowly, avoiding heavy loads.
- Do not climb with a chest infection, a bad cold or flu-like symptoms.

Treatment of high-altitude pulmonary oedema
Patients with pulmonary oedema are dangerously ill and should be evacuated to a lower altitude as an emergency. Frequently, a descent of only 500m (1,500ft) is sufficient to improve the situation dramatically. Principles of treatment include:

- Sitting the patient upright.
- DESCENT, evacuation, oxygen (treat the problem seriously).

- Nifedipine (Adalat). Take a 10mg tablet under the tongue and then a 20mg slow-release tablet four times daily.
- Hyperbaric chambers (portable pressure bags). These require the patient to lie flat and are difficult to use in this setting.

Cerebral oedema

Cerebral oedema is another severe form of altitude-related illness. It is usually preceded by AMS. It is due to fluid collecting within the brain. Patients become headachy, irrational, drowsy and confused over a period of hours, and their walking becomes unsteady. Double vision may occur. The condition is a serious one and evacuation to lower altitudes is mandatory. Principles of treatment include:

- DESCENT, evacuation, oxygen
- Dexamethasone 8mg by mouth, followed by 4mg every 4 hours for 24 hours
- Hyperbaric chamber (portable pressure bag).

In both pulmonary and cerebral oedema medical advice is desirable, although it may not be available. Those who are suspected of having pulmonary or cerebral oedema should be evacuated to lower altitude promptly. This frequently causes difficulties for the party as a whole. Patients should certainly not go high again until they have been seen by a doctor. Complete recovery is usual in both conditions if patients have been treated early and appropriately.

Treatment of severe altitude sickness, type unknown

- DESCENT, evacuation, oxygen
- Dexamethasone as above
- Nifedipine as above
- Hyperbaric chamber.

Peripheral oedema and retinal haemorrhages

Fluid retention causing swelling of an arm, a leg or the face is sometimes noticed on waking or after a long march. This is peripheral oedema. It usually subsides over several days and does not herald pulmonary or cerebral oedema.

Haemorrhages into the retina (minute blood blisters in the back of the eye) are known to occur quite commonly around 5,000m but rarely cause any problems, being unnoticed by the subject and visible only to a trained observer with specialist equipment (an ophthalmoscope). Very occasionally these tiny haemorrhages interfere with vision (causing a "hole" in the vision); descent is advised and complete recovery is usual.

Other problems

Cold and frostbite and their prevention and treatment are dealt with in Chapter 25.

Prevention of sunburn is essential. Although many proprietary creams and blocks are available, RoC Crème Ecran Total Protection Extreme (SPF 25) and Uvistat are particularly recommended. Simply covering exposed parts with silk or cotton masks is equally effective.

Snowblindness is a severe conjunctivitis (inflammation of the white of the eye) and keratitis (inflammation of the cornea) caused by exposure to UV light reflected off snow. This can happen in a matter of hours. Spare sunglasses should always be carried, and if these are not available a simple mask of cardboard or material with a thin slit to peer through can be used. Snowblindness is recognised by intensely red, painful eyes (see Chapter 25 for details on treatment). Recovery is usual within several days.

Patients who have had treatment for short-sightedness using laser or radial keratotomy should seek specialist ophthalmic advice before climbing to high altitude, as some recent studies have reported a change in refractive power at high altitude that may be visually disabling.

Summary

AMS is a common and minor, although debilitating, problem of high altitude. Rarely it leads to two potentially fatal conditions – pulmonary and cerebral oedema – both of which are medical emergencies.

In giving advice about travel to high altitudes it must be stressed that the simple adage of travelling slowly and descending if you are ill – advice known for generations in all high-altitude countries – cannot be bettered.

SUPPLIES FOR HIGH-ALTITUDE EXPEDITIONS

Medication

1. Acetazolamide (Diamox) 125mg by mouth twice daily for 5 days.
2. Dexamethasone 4mg tablets. Take 8mg at once and 4mg every 4 hours for up to 2 days.
3. Nifedipine (Adalat) 10mg under the tongue at once and 20mg slow-release tablets every 6 hours for 2 days.
4. Oxygen by mask, if available.
5. Portable hyperbaric chamber.

Pressure bags

Portable hyperbaric pressure chambers, which are bags inflated by a foot pump, can be life-saving and can buy time. The patient is placed in a sleeping bag and then in the chamber which is finally zipped up. A simulated descent of 500m or more can be

Figure 26.2 *Testing a portable pressure chamber at high altitude – Sepu Kangri Base Camp, 4,700m, eastern Tibet (C. Bonington, Chris Bonington Picture Library)*

achieved in less than 15 minutes. Any expedition to altitudes of over 5,000m should consider carrying a pressure bag. They weigh less than 10kg.

Pressure bag suppliers

GAMOW Bag
Hyperbaric Technologies Inc.
PO Box 69, Amsterdam
NY 12010, USA
Tel. +1 800 382 2491, fax +1 800 842 1031

CERTEC Bag
CERTEC
Sourcieux-les-Mines
69210 France
Tel. +33 74 70 39 82

Portable Altitude Chamber
CE Bartlett Pty Ltd
PO Box 49, Wendouree
VIC 3355, Australia
Tel. +61 3 5339 3103, fax +61 3 5338 1241

Each of these systems is reliable. The Portable Altitude Chamber is the cheapest at present. Offers are sometimes made by the manufacturers, and it may be possible to borrow or hire equipment in Kathmandu (try Himalayan Rescue Association, PO Box 4044, Thamel, Kathmandu) and other centres.

UIAA Mountain Medicine Centre via the British Mountaineering Council
The MMC produce eleven useful Information Sheets for climbers and trekkers:

1. Mountain Sickness, Oedemas and Travel to High Altitude
2. Climbing at Extreme Altitudes above 7,000m
3. Diamox, Decadron and Nifedipine at High Altitudes
4. Portable Compression Chamber in Acute Mountain Sickness
5. First Aid Kits
6. Sunscreens and Altitude
7. International Transport of Drugs and Oxygen from Britain
8. Oxygen Systems Available for Use at High Altitudes
9. Causes of Death at Extreme Altitude
10. Frostbite – Practical Suggestions
11. The Oral Contraceptive Pill and High Altitudes

These are available from:
British Mountaineering Council (BMC)
177–179 Burton Road
West Didsbury
Manchester M20 2BB
Tel. +44 161 445 4747, fax +44 161 445 4500
Email: info@thebmc.co.uk