

HIGH ALTITUDE TRAVEL NOTES

*Here is a VERY thorough overview of high altitude sickness in many of its forms,
as explained by Dr. Jim Duff. Please review for your safety on Kilimanjaro.*

(Dr Jim Duff, 01/04/2008)

More useful information on these and other subjects can be found in my book 'Pocket First Aid and Wilderness Medicine', which can be obtained via www.treksafe.com.au.

As you ascend to altitudes above 2000m, your body has to acclimatize to the decreasing amount of oxygen available. If the ascent is too fast and/or the height gain too much, these acclimatization mechanisms do not have time to work, and symptoms and signs of altitude illness (also called high altitude illness) will appear.

Altitude illness becomes common above 2500m and presents in the following ways:

- AMS (Acute Mountain Sickness): common but not life-threatening if dealt with correctly.
- HACE (High Altitude Cerebral Edema): less common but life-threatening.
- HAPE (High Altitude Pulmonary Edema): less common but life-threatening.

If you think you or your 'buddy' are becoming ill, TELL YOUR LEADER IMMEDIATELY. Warning: do not ascend with symptoms of altitude illness as this has led to many deaths from HAPE/HACE.

ACUTE MOUNTAIN SICKNESS (AMS)

A diagnosis of AMS is made when there has been a height gain in the last few days, AND:

- The victim has a headache (typically throbbing, often worse when bending over or lying down)
- PLUS there is one or more of the following symptoms:
 - Fatigue and weakness
 - Loss of appetite, or nausea, or vomiting
 - Dizziness, light headedness
 - Poor sleep, disturbed sleep, frequent waking, periodic breathing

HACE (HIGH ALTITUDE CEREBRAL EDEMA)

The important symptoms and signs are: severe headache, loss of physical coordination and a declining level of consciousness. This is a deadly condition and immediate descent is the treatment.

HAPE (HIGH ALTITUDE PULMONARY EDEMA)

The important sign is breathlessness. This is a deadly condition and immediate descent is the treatment. For more information on HACE and HAPE, see www.treksafe.com.au/medical/documents/altitudeillnessfordoctors_003.pdf.

TREATMENT OF MILD AMS

- Rest at the same (or lower) altitude until the symptoms clear (this will take a few hours to a few days)
- Avoid unnecessary exertion
- Keep warm, drink enough fluid to maintain hydration and occasional sugary drinks

- Rest in a semi-reclining position if this is more comfortable
- Medications for mild AMS:
 - Treat headache with ibuprofen or paracetamol
 - Consider treating persistent nausea or vomiting with prochlorperazine (Stemetil) or other anti-vomiting medication
 - Consider starting acetazolamide (Diamox) 125 to 250 mg 12-hourly for the rest of the time at altitude

Hypothermia, dehydration and low blood sugar (due to not eating) share many symptoms and signs with AMS and may be present at the same time. So always re-warm, re-hydrate, re-sugar.

If the illness is more severe, DESCEND. Other specific treatments will be given by your leader/doctor.

PREVENTING ALTITUDE ILLNESS

Above 2000m, altitude illness (AMS, HACE and HAPE) is a possibility, and above 2500m it becomes common.

- As a rough guide, above 2500m the maximum daily height gain between sleeping altitudes should not exceed 300m (slow acclimatizers) to 500m (fast acclimatizers), with a rest day every third day (or after every 1000m of ascent). Over 5000m, the daily height gain for the slow and fast acclimatizers is halved to 150m and 250 meters per day, respectively
- If you must fly or drive rapidly to 2500m or higher, spend a minimum of two nights at your arrival altitude (or lower if possible) or until symptoms disappear, before ascending further. If ascending rapidly to 3000m or higher, consider using acetazolamide (Diamox)
- Avoid overexertion and breathlessness while acclimatizing, especially if experiencing symptoms of AMS.
- Drink enough liquid to keep your urine pale and plentiful
- Avoid alcohol, excess caffeine, salt and protein
- Warning: do not ascend with symptoms of AMS, consult your leader/doctor

ADVENTURE TRAVEL ADVICE, INCLUDING TREKKING

(Dr Jim Duff, 1/04/08)

FITNESS AND TRAINING

The fitter you are, the more you will enjoy your holiday. Plan your training well in advance and seek advice if you are not sure of what is expected of you. Lack of personal fitness can cause problems. Turning back may be difficult to arrange, and causing delays in bad weather can be especially dangerous.

Over-exertion is a risk factor for altitude illness. Kilimanjaro trips involve strenuous days. On Kili, the summit day involves climbing 1200m (4000ft) and descending 2200m (7200ft). summit of Kilimanjaro, there is only 50% of the oxygen that is available at sea level. www.treksafe.com.au/medical/documents/altitudeillness.pdf for more information.

PREEXISTING MEDICAL CONDITIONS

If you suffer from any of these medical conditions: asthma, high blood pressure/heart disease, diabetes, epilepsy or mental illness; please discuss it with your doctor before your trekking holiday or wilderness adventure holiday.

Visit www.treksafe.com.au/medical/notes_for_doctors_and_leaders.htm for more information on these conditions to aid your assessment and preparation. These notes are for medical practitioners.

THE BUDDY SYSTEM

Pairing up to keep an eye on each other makes early recognition of illness/problems easier. Buddies should voice their concerns to the leader/doctor as soon as possible.

RECOGNIZING SOMEONE IS BECOMING UNWELL

These signs and changes in behavior are particularly important when they are 'out of character':

- Loss of appetite, missing meals
- Tiredness, lethargy; coming to camp late and last, going to bed early, being last to get out of bed.
- Personality changes: anxiety, irritability, excitability, anger, aggression, complaining, social withdrawal, depression, loss of concentration, talking more/less.
- Clumsiness, staggering, falling over, dropping things, inability to tie shoelaces or pack or carry one's own bag.
- Breathlessness, confusion, drowsiness
- This can be memorized as: "Grumble, mumble, stumble, tumble".

SUNBURN, BLISTERS, ETC

- Wear a wide brimmed hat to reduce the risk of sunburn and heat exhaustion. Cover up or protect noses, necks, ears, the backs of hands on walking poles, and backs of knees and calves.
- Acetazolamide (Diamox) and doxycycline (an antibiotic often taken for malaria prevention) can cause a person to sunburn more easily (photosensitivity), so extra sun protection is needed.
- Stop and treat blisters at the first sign of rubbing and apply blister dressing
- Walking poles are very useful while trekking, practice with them pre-departure
- Mittens are much warmer than finger gloves

PAINKILLERS AND MEDICATIONS

If pain relief is needed at altitude, paracetamol is a safe option, while ibuprofen is better at treating the headache of acute mountain sickness. Neither drug will mask symptoms of altitude illness.

FLUIDS

Dehydration occurs at low altitude, where heat and humidity cause excessive sweating and is also common at high altitude due to exercising in cold dry air. Travelers need to drink enough fluid (as soups, beverages or water) to keep hydrated (you are hydrated if your urine is 'pale and plentiful'. Infrequent small amounts of strong smelling, dark colored urine means you are dehydrated)! Discipline yourself to stop and drink at least every hour.

DIARRHEA (AND FOOD POISONING)

Diarrhea in developing countries has a greater than 50% incidence for first-time travelers staying for more than a short time. In these countries it is more likely to need antibiotic treatment than it is at home. Diarrhea can vary from mild to severe; it can result in dehydration and salts loss with resulting depletion of energy and fitness. This can result in failure to complete your holiday, trek or to summit. Reduce your risk of diarrhea by frequent hand washing/drying and avoiding hand-to-mouth contact.

PORTER CARE

If you employ porters directly or indirectly through a company, you must take care of them. This means they should have adequate clothing, footwear, food and shelter. This is especially so above the tree line. The maximum legal load a trekking porter should carry varies from country to country: 20 kg on Kilimanjaro, 25 kg in Peru and 30 kg in Nepal. Many trekkers take far too much 'stuff' with them and you should aim to travel light. If you want to take more, be prepared to hire another porter. If you are concerned for your porters speak out there and then! More information about porters and their needs can be found on <http://www.ippg.net/>.

ALTITUDE ILLNESS: AMS, HACE AND HAPE

*Notes for doctors and trek/expedition leaders
(Dr Jim Duff, 03/01/2007)*

As you ascend to altitudes above 2000m, your body has to acclimatize to the decreasing amount of oxygen available. The three main acclimatization mechanisms are:

- Deeper breathing and an increased respiratory rate (from 8 to 12 breaths/min at rest at sea level to around 20 breaths/min at 6000m). This starts immediately on arrival at altitude.
 - Producing more urine. This starts within hours and takes a day or two. If this mechanism is not efficient, the characteristic puffiness of early AMS appears in the face, hands and feet. (Water retention)
 - An increase in the number of red cells in the blood. This only begins after a week at high altitude. If the ascent is too fast and/or the height gain too much, these mechanisms do not have time to work, and symptoms and signs of altitude illness (also called high altitude illness or altitude sickness) will appear. Altitude illness becomes common above 2500m and presents in the following ways:
- AMS (Acute Mountain Sickness): common but not life-threatening if dealt with correctly.
 - HACE (High Altitude Cerebral Edema): less common but life-threatening.
 - HAPE (High Altitude Pulmonary Edema): less common but life-threatening. Depending on the altitude gain and speed of ascent, the incidence AMS ranges from 20 to 80%. HAPE is roughly twice as common as HACE and together they occur in approximately

1 to 2% of people going to high altitude. These three forms of altitude illness can vary from mild to severe, and may develop rapidly (over hours) or slowly (over days). HACE and HAPE can occur individually or together.

People often refuse to admit they have altitude illness and blame their symptoms on cold, heat, infection, alcohol, insomnia, exercise, unfit fitness or migraine, and risk death by continuing to ascend.

Warning: do not ascend with symptoms or signs of altitude illness, as this has led to many deaths from HAPE/HACE.

RISK OF DEVELOPING ALTITUDE ILLNESS

In any group there will be 'fast' and 'slow' acclimatizers needing different ascent rates. While a flexible schedule is always preferred, the fact is that many trekkers are on tight schedules (Often, but not always, members of commercial groups) leading to a higher incidence of altitude illness. Slow acclimatizers in these tight schedule situations are at extra risk, and prompt diagnosis and treatment becomes even more important. However, even if a trekker has a flexible schedule, they may still feel pressurized to ascend with symptoms (by pride, peer pressure, rivalry, not wanting to appear weak, etc). Interestingly, fit and impatient young people can be more at risk of altitude illness than unfit and patient older ones!

AMS (ACUTE MOUNTAIN SICKNESS)

AMS varies from mild to severe and the main symptoms are due to the accumulation of fluid in and around the brain. Typically, symptoms appear within 12 hours of the ascent. If the victim now rests at the same altitude, symptoms usually disappear quickly over several hours (but for 'slow acclimatizers' this can take up to 3 days!) And they are now acclimatized to this altitude. AMS may reappear as they ascend higher still, as acclimatization to the new altitude has to take place all over again.

SYMPTOMS & SIGNS

A diagnosis of AMS is made when there has been a height gain in the last few days, AND:

- The victim has a headache (typically throbbing, often worse when bending over or lying down)
- PLUS there is one or more of the following symptoms:

- Fatigue and weakness

- Loss of appetite, or nausea, or vomiting
- Dizziness, light headedness
- Poor sleep, disturbed sleep, frequent waking, periodic breathing

In AMS, the victim's level of consciousness is normal.

Note: AMS and HACE are two extremes of the same condition and it can help to think of AMS as 'mild HACE'. The only early signs of altitude illness in a young child (under 7 years old) may be an increased fussiness, crying, loss of interest and/or loss of appetite.

HACE (HIGH ALTITUDE CEREBRAL EDEMA)

HACE is the accumulation of fluid in and around the brain. The important symptoms and signs are: severe headache, loss of physical coordination and a declining level of consciousness. Typically, symptoms and signs of AMS become worse and HACE develops (but HACE may come on so quickly that the AMS stage is not noticed). Also, HACE may develop in the later stages of HAPE.

SYMPTOMS & SIGNS

A diagnosis of HACE is made when there has been a height gain in the last few days, AND:

- The victim has a severe headache (not relieved by ibuprofen, paracetamol or aspirin)
- There is a loss of physical coordination (ataxia):
 - Clumsiness: the victim has difficulty (and often asks for help) with simple tasks such as tying their shoelaces or packing their bag. When examined they fail to do, or have difficulty doing (or refuse to do!) the finger-nose test
 - Staggering, falling over. When examined they fail to do, or have difficulty doing (or refuse to do) the heel-to-toe walking test or the standing test
- Their level of consciousness is declining:
 - Early on, this presents as loss of mental abilities such as memory or mental arithmetic. When asked, the victim cannot do or have difficulty doing (or refuse to do) simple mental tests
 - Later on, they become confused, drowsy, semiconscious, unconscious (and will die if not treated urgently)
- Other symptoms and signs that may appear:
 - Nausea and/or vomiting, which may be severe and persistent
 - Changes in behavior (uncooperative, aggressive or apathetic, "Leave me alone", etc)
 - Hallucinations, blurred or double vision, seeing halos around objects, fits or localized stroke signs may all occur but are less common

TESTS FOR HACE

Failure or difficulty doing any one of these tests means the victim has HACE. If the victim refuses to cooperate, assume they are suffering from HACE. If in doubt about the victim's performance of the tests, compare with a healthy person. Be prepared to repeat these tests to monitor progress.

- Finger-nose test. With eyes closed, the victim repeatedly and rapidly alternates between touching the tip of their nose with an index finger, then extending this arm to point into the distance (useful test if the victim is in a sleeping bag or cannot stand up).
- Heel-to-toe walking test. The victim is asked to take 10 very small steps in a straight line, placing the heel of one foot in front of the toes of the other foot as they go. Reasonably flat ground is necessary and the victim should not be helped, but be prepared to catch the victim if they fall over! Excessive wobbling is difficulty (to do the test), falling over is failure.

- Standing test. The victim stands, feet together and arms folded across their chest, and then closes their eyes (the victim should not be helped, but be prepared to catch the victim if they fall over! Excessive wobbling is difficulty (to do the test), falling over is failure.
- Mental tests are used to assess level of consciousness. You must take into consideration pre-existing verbal/arithmetic skills and culture; it is a decline in ability over time that is significant. Examples of tests include: "Spell your name backwards", "Take 3 from 50 and keep taking 3 from the result", or ask their birth date, about recent news events, etc.

H A P E (H I G H A L T I T U D E P U L M O N A R Y E D E M A)

HAPE is the accumulation of fluid in the lungs. The important sign is breathlessness. HAPE may appear on its own without any preceding symptoms of AMS (this happens in about 50% of cases) or it may develop at the same time as AMS or HACE. Severe cases of HAPE may result in the development of HACE in the later stages. HAPE may develop very rapidly (in 1 to 2 hours) or very gradually over days. It often develops during or after the second night at a new altitude. HAPE can develop while descending from a higher altitude. It is the commonest cause of death due to altitude illness. HAPE is more likely to occur in people with colds or chest infections. It is easily mistaken for a chest infection/pneumonia. If you have the slightest doubt, treat for both.

S Y M P T O M S & S I G N S

- Reduced physical performance (tiredness, fatigue) and a dry cough are often the earliest signs of HAPE
- Breathlessness:
 - Early stages: more breathless than usual with exercise, takes a little longer to get breath back after exercise
 - Later stages: marked breathlessness during exercise, takes longer to get breath back after exercise. This finally progresses to breathlessness at rest
 - At any stage, the victim may become breathless while lying flat and prefer to sleep propped up
- Breathing rate at rest increases as HAPE progresses. (At sea level, resting breathing rate is 8 to 12 breaths/min at rest. At 6000m, normal acclimatized resting breathing rate is approximately 20 breaths/min)
- A dry cough
- As HAPE gets worse, the cough may start to bring up white frothy sputum. Later still, this frothy sputum may become bloodstained (pink or rust colored): this is a serious sign
- 'Wet' sounds (fine crackles) may be heard in the lungs when the victim breathes in deeply (place your ear on the bare skin of the victim's back below the shoulder blades; compare with a healthy person)
- Note: wet sounds may be difficult to hear (or absent), even in severe HAPE
- As HAPE gets worse, lips, tongue or nails may become blue due to lack of oxygen in the blood
- There may be: fever (up to 38.5°C), a sense of inner cold, or pains in the chest or even upper belly
- As HAPE worsens, the victim becomes confused, drowsy, semiconscious, unconscious (and will die if not treated urgently)

W H A T E L S E C O U L D I T B E ?

If the illness comes on after 4 days at a new altitude and/or does not respond to descent, oxygen, dexamethasone and/or nifedipine, reconsider your diagnosis:

- HACE may be difficult to distinguish from: migraine, meningitis, diabetic coma, CO poisoning
- HAPE may be difficult to distinguish from: pneumonia, asthma, pulmonary embolus (a blood clot from a DVT), heart attack, hyperventilation (panic attack)
- Hypothermia, dehydration or low blood sugar (due to not eating) share similar symptoms to altitude illness
Unless absolutely sure, treat as HACE or HAPE (or both) PLUS your alternative diagnosis.
Note: the basic treatment of all of these problems is roughly the same: re-warm, re-hydrate, 're-sugar', re-oxygenate and descend.

TREATMENT OF ALTITUDE ILLNESS

If someone is ill at altitude after a recent height gain, carry out a full secondary survey (especially level of consciousness and breathing rate), a 'Lake Louise Score' and the tests/examination for HACE and HAPE.

Because the victims of altitude illness often fail to take care of themselves, they are likely to develop hypothermia, dehydration and/or low blood sugar (due to not eating). There comes a point when it is vital that the leader/doctor/companion starts making decisions for the victim (e.g. ordering immediate descent), even if the victim disagrees.

GENERAL TREATMENT OF ALTITUDE ILLNESS:

- Descent is the treatment of altitude illness. Prompt descent will begin to reverse the symptoms. Descend immediately if symptoms are severe, even if it means at night or in bad weather. Resting at the same altitude is only acceptable if the victim has mild AMS and is improving with treatment
- Oxygen: give oxygen, either as bottled oxygen or in a hyperbaric bag if the symptoms are severe and descent is not immediately possible (e.g. dangerous terrain or weather, not enough helpers to carry an unconscious victim, waiting for a helicopter) or the victim is too ill to move
- Rest is recommended even for mild symptoms. With more serious illness, if at all possible avoid even the slightest exertion, as just walking a few steps may make symptoms worse or reappear; carry the victim or, as a minimum, assist them to walk and carry their rucksack
- Keep the victim warm and hydrated, give occasional sugary drinks
- Prop the victim up in a semi-reclining position, as lying flat can make them feel worse
- If at any stage the victim has difficulty breathing, is turning blue or lapsing into unconsciousness, assist their breathing with mouth-to-mouth before they stop breathing.

GOING BACK UP AGAIN?

- Anyone seriously ill with HACE or HAPE needing oxygen, treatment in a hyperbaric bag or dexamethasone or nifedipine, should descend immediately after treatment. As, even if they feel completely recovered, symptoms may rapidly re-appear with even mild exertion or further ascent.
- Cautious re-ascent may be considered once symptom-free for 4 weeks (ideally seek the advice of a doctor qualified in mountain medicine). Long haul jet flights should be avoided while symptomatic, unless oxygen is available
- If re-ascent is unavoidable (e.g. driving out of Tibet over high passes), give:
 - Acetazolamide 250 mg 12-hourly
 - If the original problem was HACE, add dexamethasone (4 mg 12-hourly)
 - If the problem was HAPE, add modified release nifedipine (20 mg 12-hourly)
 - Give oxygen while crossing passes
- If symptoms of AMS disappear and the person is feeling well (and has been off dexamethasone for at least 3 days), they may try re-ascending slowly while continuing to take acetazolamide. Otherwise, continue descending Acetazolamide (Diamox) Acetazolamide increases the breathing rate at altitude and speeds up the acclimatization process. A dose takes 12 hours to become fully effective. Acetazolamide does NOT mask the onset of AMS, HACE or HAPE. However, taking acetazolamide does not guarantee that altitude illness will not develop.

THERE ARE THREE SITUATIONS WHERE ACETAZOLAMIDE IS USEFUL:

1. PREVENTION OF AMS ACETAZOLAMIDE REDUCES THE INCIDENCE OF AMS, HOWEVER ROUTINE PREVENTATIVE USE FOR ALL TREKKERS ON ALL TREKS IS NOT RECOMMENDED. IT IS RECOMMENDED FOR THOSE WHO HAVE A PAST HISTORY OF ALTITUDE ILLNESS, OR FOR EVERYONE WHEN RAPID HEIGHT GAIN IS UNAVOIDABLE, SUCH AS:

- Any ascent to 5000m or more (e.g. Kilimanjaro 5895m) under 7 days: consider using 125 to 250 mg 12-hourly from the start of the ascent until back below 3000m
- Flying or driving rapidly to altitude (e.g. Lhasa 3660m, Leh 3500m, Cuzco 3470m, La Paz 3880m, etc): consider using 125 mg 12-hourly, start 24 hours before flying and continue for 2 or 3 days after arrival or the rest of the time at altitude. This is especially useful if the traveler's itinerary does not allow for 2-3 rest days on arrival at altitude.

2. TREATMENT OF ALTITUDE ILLNESS

If someone with mild AMS has a flexible schedule, the preferred option is to rest at the same altitude until symptoms disappear. This ideal approach is sometimes not possible on treks and the argument for prompt use of acetazolamide is stronger. In this situation, a person with persistent symptoms of mild AMS despite treatment should start acetazolamide (125 to 250 mg 12-hourly) as this offers the best chance to safely continue their trek (given that no-one should ascend with symptoms of altitude illness). See treatment of more severe AMS, HAPE or HACE above.

3. POOR SLEEP, DISTURBED SLEEP OR PERIODIC BREATHING AT ALTITUDE

Poor sleep is common at altitude; first, check warmth of sleeping bag, improve ground insulation, avoid caffeine, check peeing arrangement and offer reassurance to the anxious. A trial of acetazolamide is indicated for sleep disturbance at altitude, particularly if the insomnia is associated with periodic breathing. This is recognized by repeated cycles of normal or fast breathing followed by a long pause, then several gasping breaths. The sufferer often wakes feeling like they are suffocating. This can be frightening for the sufferer's tent 'buddy'! In the morning the victim feels tired and unwell. Acetazolamide is often called 'the high altitude sleeping pill' (125 mg one hour before going to bed. If the problem persists, increase the dose to 250 mg).

ACETAZOLAMIDE: ALLERGY AND SIDE EFFECTS

The side effects of acetazolamide include allergy. Avoid it if there is a history of a severe allergic reaction to acetazolamide or sulfa containing medications (mainly the sulphonamidetype antibiotics such as co-trimoxazole, Septrin™, Bactrim™). Note that if the sulfa allergy is mild (rash, diarrhea, etc), test doses of acetazolamide (125 mg 12-hourly for 2 days) may be tried well before departure (but do not attempt this if the sulfa allergy is severe!). Most people with mild sulfa allergy can take acetazolamide. Common side effects of acetazolamide include:

- Paraesthesiae (tingling) in lips, fingers, toes or other body parts and a metallic taste when drinking carbonated drinks are the most obvious. Both side effects are milder with lower doses and disappear on stopping the medication
- Acetazolamide can cause photosensitivity (sunburn more easily) so use hats, gloves, sunscreen
- Extra urine output. The effect of acetazolamide to increase urine output is mild (people pee more as part of the normal acclimatization process as they ascend)
- Rarer side effects include: flushing, headache, dizziness, nausea, diarrhea, tiredness

Note: the medication acetazolamide used for Acute Mountain Sickness has to be obtained from a doctor on prescription. As its use for AMS is not officially recognized, some doctors may be reluctant to prescribe it for you. Showing your doctor this handout may help.

MEDICATIONS AT ALTITUDE

- At altitude (above 2500m) some medications such as sedatives, strong painkillers, antihistamines and most sleeping tablets (except zopiclone and zolpidem) may depress breathing. This may make altitude illness more likely or more severe, especially at night. If you have to use any of these medications, consider giving acetazolamide (Diamox) 125 to 250 mg 12-hourly to stimulate breathing, and check the person frequently.
- At altitude, antimalarial medications may cause nausea and psychotic episodes
- Oral contraceptives ("the pill") slightly increase the blood's tendency to clot, so they should be avoided above 5000m
- Aspirin and NSAIDs (non-steroidal anti-inflammatory drugs, e.g. ibuprofen) may cause bleeding in the eye (retina) at high altitude (over 5000m) especially if coughing is present.