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Altitude Sickness

Altitude sickness can affect people who climb or travel (ascend) to more than 2500 metres (8,000 feet) altitude, particularly if they ascend too quickly.

For most people, it causes mild symptoms that improve with rest and time spent getting used to altitude. However, in some people, it can lead to serious symptoms which can become life-threatening. This is particularly the case if the signs are not recognised and the person does not move down (descend) to a lower altitude.

The most important treatment if you develop symptoms of altitude sickness is to stop your ascent and rest. If your symptoms are severe, do not improve, or they are getting worse, you need to descend to a lower altitude. There are various preventative measures, the most important being slow ascent so that your body can adjust to conditions at the right pace (acclimatise).

What is a high altitude?

- High altitude is an altitude between 1500-3500 metres (5,000-11,500 feet).
- Very high altitude is an altitude between 3500-5500 metres (11,500-18,000 feet).
- Extreme altitude is an altitude above 5500 metres (18,000 feet).

What are the normal responses of the body to altitude?

As you move up (ascend) to higher altitudes, air pressure reduces. Air still contains the same proportion of oxygen (21%) at high altitude. However, because of the lower air pressure, there is actually less oxygen available because the air is thinner (it contains less of all of the gases in a given volume). So, at high altitude, each breath that you take will contain fewer oxygen molecules. This means that you have to breathe faster and deeper to get oxygen into your body.

After a few days, your body starts to adjust (acclimatise) to the higher level of altitude that you are at. You will notice that your breathing rate will start to slow down. Your body also makes more red blood cells to help with oxygen transport around your body.

Because of these changes in your body, there are some 'normal' symptoms that you will notice at higher altitudes while your body is acclimatising and adjusting to the reduced availability of oxygen. They include:

- An increased breathing rate or feeling that you are breathing more deeply.
- Shortness of breath on exercise or increased activity (exertion).
- A change in your breathing pattern at night.
- Disturbed sleep.
- Passing more urine than usual.

What is altitude sickness?

Altitude sickness is something that can affect people who climb or travel to an altitude of more than 2500 metres, particularly if they climb or travel up (ascend) too quickly. It is rare at altitudes of less than 2500 metres (8,000 feet) and is more common at altitudes of 3500 metres (11,500 feet) or more. Just to give an idea, you can commonly ski at an altitude of 2500 metres in a ski resort.

Altitude sickness is due to the fact that your body has not got used (acclimatised) to the altitude that you are now at. For most people, it just produces mild symptoms that improve with rest and time spent at altitude. However, in some people, it can lead to more serious symptoms which can become life-threatening. This is particularly a risk if the signs are not recognised and the person does not move down (descend) to a lower altitude.

There are three main ways that altitude sickness can affect you. You may develop one or more of the following problems:

- Acute mountain sickness (AMS).
- High-altitude cerebral oedema (HACO or HACE. Oedema is spelt edema in some countries, so this condition can be shortened to either HACE or HACO).
- High-altitude pulmonary oedema (HAPO or HAPE).

Each of these is explained in more detail below.

How common is altitude sickness?

This varies with the location and with the way people tend to climb (ascend). It is common in places where visitors try to ascend very quickly - for example, climbing Mt Kilimanjaro. It is also more common in places where it is possible to fly to a high altitude to start with, before climbing further. This is the case, for example, with the Everest Base Camp trek in Nepal, where the trek often begins by flying to Lukla at an altitude of 2860 metres (9,000 feet). Up to half of trekkers may develop altitude sickness in this situation. In Colorado, about a quarter of visitors sleeping higher than 2500 metres (8,000 feet) develop altitude sickness. HACE and HAPE are much less common than AMS.

If proper preventative measures are taken (such as not ascending too fast), AMS can be less common.

Who is at risk of altitude sickness?

It is difficult to predict who will be affected by altitude sickness. However, your risk is higher:

- If you climb (ascend) to altitude too quickly. (This may particularly be a risk if you start your trip by flying to an altitude of more than 2750 metres, or 9,000 feet.)
- As the altitude to which you climb or travel is higher.
- As the altitude at which you sleep is higher.
- If you have come from, and are used to living in, a very low altitude.
- If you have had altitude sickness before. (This makes it more likely you will have it on another occasion. However, even if you did not develop it on one occasion, it does not mean you definitely will not develop it another time.)
- If you have an individual susceptibility to developing altitude sickness - genetics may play a part in your susceptibility.
- If you have a high level of exertion (ie are very physically active) at altitude. The more active you are, the greater the risk.

Note that your level of physical fitness does not seem to play a part in your chances of developing altitude sickness. Being more fit does not make you more likely to develop altitude sickness. However, if you are more fit, you may be tempted to try to ascend too quickly.

Can altitude sickness be prevented?

There are a number of things that may help to prevent altitude sickness. The best way to try to prevent altitude sickness is to climb (ascend) to higher altitudes slowly. This gives time for your body to adjust to conditions (acclimatise). It allows your body to cope with lower oxygen levels. Different people will acclimatise at different rates.

- There are recommended rates of ascent to altitude to help with adjusting to conditions (acclimatisation):
    - If possible, spend at least one night at an 'intermediate' elevation below 3000 metres.
    - Above 3000 metres, increase your sleeping altitude by only 300-500 metres per day.
    - Above 3000 metres, take a rest day for every 1000 metres of elevation gained (ie spend a second night at the same altitude).
    - If possible, don't fly or drive directly to high altitude.

- If you do go directly to high altitude by car or plane, do not over-exert yourself or move higher for the first 24 hours.
- Always try to sleep at a lower altitude. Climbers commonly use the phrase, "climb high, sleep low".
- Take special care if you have previously had acute mountain sickness (AMS).
- When planning an ascent as a group, plan for members acclimatising at different rates. How will you support those remaining behind to recover from AMS?
- If symptoms of AMS develop, delay further ascent.
- If symptoms become worse, move down (descend) as soon as possible.

Acute mountain sickness

What causes AMS?

The exact cause of AMS is not exactly known. It is thought to be a response of the brain to the lower oxygen levels in the blood at higher altitudes. This produces some swelling of the brain.

What are the symptoms of AMS?

For most people, AMS will give mild symptoms. Sometimes these are described as being rather like the symptoms of a hangover. Common symptoms can include headache, loss of appetite, tiredness and feeling sick (nausea). Other possible symptoms are being sick (vomiting), feeling light-headed or dizzy and having difficulty sleeping.

These symptoms tend to come on 6 to 12 hours after arrival at a particular altitude. At which altitude this is will depend on the individual person and situation. Symptoms usually get better after 1 to 3 days, provided that you do not climb (ascend) to a higher altitude. Symptoms can vary from mild to severe. Mild symptoms can be quite vague. It is best to assume that, if you are at altitude and you feel unwell, you have AMS unless there is another obvious cause.

If you experience any of these symptoms at altitude and wonder whether you have AMS, you can score yourself to find out.

How do I calculate my own score?

The Lake Louise score is a scoring system used to make a diagnosis of AMS. This is something you can do yourself to decide how severe your symptoms are and what they mean. The scoring is as follows:

Symptom	Severity	Score
Headache	No headache Mild headache Moderate headache Severe headache	0 1 2 3
Gut (gastrointestinal) symptoms	None Poor appetite or nausea Moderate nausea and/or vomiting Severe nausea and/or vomiting	0 1 2 3
Fatigue and/or weakness	Not tired or weak Mild fatigue/weakness Moderate fatigue/weakness Severe fatigue/weakness	0 1 2 3
Dizziness/light-headedness	Not dizzy Mild dizziness Moderate dizziness Severe dizziness	0 1 2 3
Difficulty sleeping	Slept as well as usual Did not sleep as well as usual Woke many times, poor sleep Could not sleep at all	0 1 2 3

A total score of 3 to 5 = mild AMS and 6 or more = severe AMS. Remember that any symptoms at altitude are altitude illness until proven otherwise.

What is the treatment for AMS?

The most important treatment if you start to develop symptoms of mild AMS is to stop your ascent and to rest at the same altitude. For most people, symptoms will improve within 24-48 hours with no specific treatment. Adjusting to conditions (acclimatisation) usually occurs after 1 to 3 days at a given altitude. Simple painkillers such as ibuprofen or paracetamol will help the headache. Anti-sickness medication may also be used.

Other medicines are sometimes prescribed. The most common is a medicine called acetazolamide. Acetazolamide can also be given to prevent AMS. It is thought that acetazolamide helps to 'speed up' your acclimatisation. You can only buy acetazolamide from a chemist if they have gone through extra training to provide it through a 'patient group direction' service (you can ask at your pharmacy). Otherwise you will require a prescription from your GP. The usual dose of acetazolamide for prevention is 125 mg twice a day. A common side-effect with acetazolamide is pins and needles. A steroid medication called dexamethasone may be an alternative. Sometimes oxygen treatment may be used.

However, if your symptoms are severe, they do not improve after 24 hours, or they are getting worse, you need to move down (descend) to a lower altitude. You also need to descend urgently if you develop any symptoms or signs of HACE or HAPE (see below).

Tell me more about medications to prevent acute mountain sickness

Acetazolamide can be used for the prevention as well as treatment of AMS.

There is also evidence that dexamethasone can be used to prevent AMS. However, this is not recommended for routine use in travellers to high altitudes. Other options are being studied - for example, ibuprofen. However, there is not yet any evidence that it is as effective as acetazolamide. Until further studies are done, it is best not to take this to prevent AMS.

There is no reliable evidence for any other medications (including gingko biloba) at present. In some parts of South America travellers to high altitude may be offered coca leaves. These can be used to make tea or the leaves can be chewed. These are known to act as a mild stimulant but there is no evidence they help prevent AMS.

High-altitude cerebral oedema

What causes high-altitude cerebral oedema (HACE)?

HACE usually develops in someone who already has AMS. The swelling of the brain that has led to AMS gets worse and starts to interfere with the function of the brain. So, HACE is really a severe form of AMS.

What are the symptoms of HACE?

Symptoms of HACE include:

- Headache, which may be very severe.
- Feeling sick (nausea).
- Being sick (vomiting).
- Being uncoordinated, unsteady or off-balance.
- Hallucinations (for example, seeing or hearing things that are not actually there).
- Feeling disorientated.
- Feeling confused.

Often these symptoms are not noticed by the person who is developing HACE, or by their companions. As the cerebral oedema gets worse, people become more sleepy and less aware of their surroundings. They may have fits (seizures). Coma and death can occur if treatment is not started.

HACE can develop quickly, over a few hours. It is possible to have symptoms of high-altitude pulmonary oedema (HAPE) as well, ie to have both conditions at the same time. See below for information about HAPE.

What is the treatment for HACE?

This is a move down (a descent) to a lower altitude **immediately**. If this does not happen, or is delayed, death can occur. It may be necessary to descend at night, if this is possible, and this could be life-saving. Treatment with oxygen (if possible) and the steroid medicine dexamethasone can help to relieve symptoms and can mean that getting someone down to a lower altitude becomes easier. However, these treatments do not remove the need for descent. The descent should be at least to the last altitude at which the person woke up feeling well.

A device called a portable hyperbaric chamber may be used. It is, essentially, an airtight bag big enough for a person to fit in, that is pressurised by a pump. The person with HACE is placed inside it and it can provide the same effect as (simulate) descent. The person will be breathing air equivalent to that at much lower altitude. This can be life-saving when descent is not possible and oxygen is unavailable.

What is the prognosis for HACE?

People with HACE usually do well if they descend to a lower altitude soon enough and far enough. The outlook (prognosis) is that they will usually have a complete recovery.

High-altitude pulmonary oedema

What causes high-altitude pulmonary oedema (HAPE)?

'Pulmonary' refers to the lungs and 'oedema' means that there is a build-up of fluid. So, pulmonary oedema is a build-up of fluid within the lungs. The exact reasons why HAPE can develop are unknown. It is thought that the high altitude causes an increase in pressure in some of the small blood vessels of the lungs which leads to smaller blood vessels becoming 'leaky'. This allows fluid to escape from the blood vessels into the lungs.

What are the symptoms of HAPE?

If someone develops HAPE, the symptoms usually start to appear a few days after arrival at altitude. Symptoms start with shortness of breath on exertion. It then worsens, so that there is shortness of breath even when resting. People affected can also develop a cough and feel generally weak and tired. They may start to cough up pink/frothy liquid (sputum) and complain of chest tightness. They may have swelling of their ankles or legs and their lips or fingernails may be blue or grey. In severe cases they become extremely short of breath at rest and drowsy. Coma and death can occur if HAPE is not treated quickly.

HAPE can happen in someone who also has AMS or HACE, or they may have no obvious symptoms of these other problems.

What is the treatment for HAPE?

Again, someone with HAPE needs to move down (make a descent) to a lower altitude immediately. Even a descent of a few hundred metres can make a difference but ideally descent should be to the point where symptoms are better. Treatment with oxygen and the medicine nifedipine may also help symptoms but does not replace the need for descent.

A hyperbaric chamber (as explained above) can be used if descent is not possible and/or oxygen and other treatment are not available.

What is the prognosis for HAPE?

HAPE tends to get better quickly on descent and outlook (prognosis) is that there is usually complete recovery.

Further reading & references

- Foreign Travel Advice by Country; GOV.UK
- The World Factbook; Central Intelligence Agency
- NHS Fit For Travel: Travel health information for people travelling abroad from the UK; Health Protection Scotland
- Information on carrying medication overseas; International Narcotics Control Board
- Apply for a European Health Insurance Card; GOV.UK
- Sleep disorders - shift work and jet lag; NICE CKS, Aug 2013 (UK access only)
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