1. HIGH ALTITUDE:

Traveling at high altitude can be hazardous. *This document is intended to be informative and educational in nature and should not at be construed as medical advice. It does not attempt to replace the advice of a certified medical practitioner, particularly one with knowledge of high altitude illnesses. Before embarking on any prolonged trip (more than one day) to altitudes in excess of 2,500 mtrs or 8,000 ft, you should consult your physician regarding specific medical conditions before taking any medications. He is the only person who can advise you on whether you are capable of journeying into high altitudes and can provide you with medication if felt necessary or advice you against undertaking the journey. At high altitudes you are living life on the edge and onset of acute mountain sickness can result in fatalities if not diagnosed promptly.*

In the middle of the Himalayas, medical help is always too far away and one needs to be prepared - always - to deal with any emergency medical situation that may arise. It is said that untrained people and non-practitioners of the medical profession should not attempt to give treatment beyond basic first aid. This essentially means, literally, that first aid should be administered in order to sustain life and to prevent the situation from deteriorating further till such time as professional medical help can be available.

What is High Altitude?

Altitude is defined on the following scale: High (8,000 - 12,000 feet [2,438 - 3,658 meters]), Very High (12,000 - 18,000 feet [3,658 - 5,487 meters]), and Extremely High (18,000+ feet [5,500+ meters]). Since few people have been to such altitudes, it is hard to know who may be affected. There are *no* specific factors such as age, sex, or physical condition that correlate with susceptibility to altitude sickness. Some people get it and some people don't, and some people are more susceptible than others. Most people can go up to 8,000 feet (2,438 meters) with minimal effect. If you haven't been to high altitude before, it's important to be cautious. If you have been at that altitude before with no problem, you can probably return to that altitude without problems as long as you are properly acclimatized.

What is Altitude Sickness?

Altitude sickness has three forms. Mild altitude sickness is called acute mountain sickness (AMS) and is quite similar to alcohol hangover - it causes headache, nausea, and fatigue**(main reason why alcohol must be avoided on the trek)**. This is very common: some people are only slightly affected, others feel awful. However, if you have AMS, you should take this as a warning sign that you are at risk of the serious forms of altitude sickness: HAPE and HACE* if not treated immediately. Both HAPE and HACE can be fatal within hours.

What causes Altitude Sickness?

Two things are certain to make altitude sickness very likely - ascending faster than 500m per day, and exercising vigorously. Physically fit individuals are not protected - even Olympic athletes get altitude sickness. Altitude sickness happens because there is less oxygen in the air that you breathe at high altitudes.

Altitude sickness prevention

Go up slowly, take it easy, and give your body time to get used to the altitude. The body has an amazing ability to acclimatise to altitude, but it needs time. For instance, it takes about a week to adapt to an altitude of 5000m.

Can I take drugs to prevent altitude sickness?

As with everything, many 'quack' treatments and untested herbal remedies are claimed to prevent mountain sickness. These treatments can make AMS worse or have other dangerous side effects - many herbs are poisonous. Only one drug is currently known to prevent AMS and to be safe for this purpose: acetazolamide (diamox). It causes some minor side effects, such as tingling fingers and a funny taste in the mouth.

The Golden Rules
1. If you feel unwell, you have altitude sickness until proven otherwise
2. Do not ascend further if you have symptoms of altitude sickness
3. If you are getting worse then descend immediately

***created by Dr David Shlim**

2. ACUTE MOUNTAIN SICKNESS:

The mild form of altitude sickness: acute mountain sickness (AMS)

Where does acute mountain sickness happen?

Most people remain well at altitudes of up to 2500m, the equivalent barometric pressure to which airplane cabins are pressurised. However, even at around 1500m above sea level you may notice more breathlessness than normal on exercise and night vision may be impaired. Above 2500m, the symptoms of altitude sickness become more noticeable.

What are the other names for acute mountain sickness?

Acute mountain sickness is sometimes colloquially referred to as altitude sickness or mountain sickness and in South America it is called soroche.

How are the symptoms of altitude sickness measured?

The most prominent symptom is usually headache, and most people also experience nausea and even vomiting, lethargy, dizziness and poor sleep. Symptoms are very similar to a really bad hangover. Acute mountain sickness can be diagnosed using a self-assessment score sheet. If you have recently ascended to over 2500m, have a headache and your total score is 3 points or more on the score sheet, then you have acute mountain sickness.

Who gets acute mountain sickness?

Anyone who travels to altitudes of over 2500m is at risk of acute mountain sickness. Normally it doesn't become noticeable until you have been at that altitude for a few hours. Part of the mystery of acute mountain sickness is that it is difficult to predict who will be affected. There are many stories of fit and healthy people being badly limited by symptoms of acute mountain sickness, while their older companions have felt fine.

There are a number of factors that are linked to a higher risk of developing the condition. The higher the altitude you reach and the faster your rate of ascent, the more likely you are to get acute mountain sickness. On the Apex high altitude research expeditions, flying from sea level to the Bolivian capital, La Paz (3600m, caused over half of the expedition members to have acute mountain sickness on the day after they arrived. If you have a previous history of suffering from acute mountain sickness, then you are probably more likely to get it again. Older people tend to get less acute mountain sickness – but this could be because they have more common sense and ascend less quickly.

What causes altitude sickness?

There is so much less oxygen in the high mountains that it is not surprising that travelling to high altitude causes people to feel unwell, but how this shortage of oxygen actually leads to altitude sickness is still not fully understood. Some scientists believe that it is due to swelling of the brain but the evidence for this hypothesis is not conclusive. The theory is that in susceptible individuals, swelling could cause a small increase in the pressure inside the skull and lead to symptoms of acute mountain sickness. The swelling may be due to increased blood flow to the brain or leakiness of blood vessels in the brain.

What are the treatments for altitude sickness (mountain sickness)?

It is better to prevent acute mountain sickness than to try to treat it. Following the golden rulesshould mean that your body can acclimatise as you ascend and so you will be less likely to develop acute mountain sickness. However, if you need to go up more quickly, you could consider taking a drug called acetazolamide (also known as Diamox). There is now good evidence that acetazolamide reduces symptoms of acute mountain sickness in trekkers, although it does have some unusual side-effects: it makes your hands and feet tingle, and it makes fizzy drinks taste funny.

As with any form of altitude sickness, if you do have acute mountain sickness, the best treatment is descent. Painkillers may ease the headache, but they don't treat the condition. Acetazolamide may be helpful, especially if you need to stay at the same altitude, and resting for a day or two might give your body time to recover. It is essential that you should **NEVER** go up higher if you have acute mountain sickness.

If a travelling companion has symptoms of acute mountain sickness and becomes confused or unsteady, or develops an extremely severe headache or vomiting, they may have a life-threatening condition called high altitude cerebral edema(HACE).

There are many other remedies touted as treatments or 'cures' for altitude sickness, but there is no evidence to support any of them

3. HIGH ALTITUDE PULMONARY EDEMA:

High altitude pulmonary edema (HAPE)

HAPE is a dangerous build-up of fluid in the lungs that prevents the air spaces from opening up and filling with fresh air with each breath. When this happens, the sufferer becomes progressively more short of oxygen, which in turn worsens the build-up of fluid in the lungs. In this way, HAPE can be fatal within hours.

What are the symptoms?

HAPE usually develops after 2 or 3 days at altitudes above 2500 m. Typically the sufferer will be more breathless compared to those around them, especially on exertion. Most will have symptoms of acute mountain sickness. Often, they will have a cough and this may produce white or pink frothy sputum. The breathlessness will progress and soon they will be breathless even at rest. Heart rate may be fast, the lips may turn blue and body temperature may be elevated. It is easy to confuse symptoms of HAPE with a chest infection, but at altitude HAPE must be suspected and the affected individual must be evacuated to a lower altitude.

Who gets HAPE?

Unfortunately, it is currently impossible to predict who will get HAPE. People who have had HAPE before are much more likely to get it again. Therefore, there must be some factor that puts certain individuals at high risk of the condition. However, just like acute mountain sickness, there are some known risk factors. A fast rate of ascent and the altitude attained will make HAPE more likely. Vigorous exercise is also thought to make HAPE more likely and anecdotal evidence suggests that people with chest infections or symptoms of the common cold before ascent may be at higher risk.

What causes HAPE?

Despite years of careful research the exact causes of HAPE remain poorly understood. Fluid has been shown to fill up the air pockets in the lungs preventing oxygen getting into the blood and causing the vicious circle of events that can kill people with HAPE. As with many biological processes many factors play a role in the disease and there is good evidence to support a number of theories about how this fluid gets there.

Normally, oxygen gets into your blood and is supplied to the body from your lungs. Each time you take a breath in, air rushes into the tiny air pockets at the end of all the airway branches in your lungs. At the same time, blood from your heart is brought close to these thin-walled air pockets, so that oxygen can move into your blood while waste products move out. Oxygen-rich blood then returns to the heart and is supplied to the body. If, by accident, you inhaled a small object into your lungs, it would become stuck

in one of the airways branches. Little oxygen would get to the downstream air pockets. To prevent this area of lung supplying blood starved of oxygen back to the heart (and therefore the rest of body), blood vessels in the area closed down or constrict. This is normally a very good thing and is an example of the body protecting itself.

At altitude however, this same process is a cause of the disease HAPE. Because the whole lung is starved of oxygen, the whole lung reacts in the same way – blood vessels constricting all over the place and not just in small areas. The blood in these vessels is squeezed and the pressure goes up forcing fluid out of blood and into air pockets.

Very dangerous and reactive substances are formed in your blood when you are starved of oxygen and these can directly damage the special membrane between air and blood in your lungs causing further fluid leak and worsening HAPE.

How is HAPE treated?

The most important treatment for HAPE is descent. Providing extra oxygen and/or raising the air pressure around a victim with a Gamow bag can reverse the underlying process, lack of oxygen, but these measures are really no substitute however for rapid descent down the mountain. Some drugs can be helpful, but should only be used by trained doctors. Nifedipine is a drug that helps to open up the blood vessels in the lungs. By doing so, it reduces the high pressure in those vessels that is forcing fluid out into the lungs. Sildenafil (Viagra®), by a different mechanism, also opens up the blood vessels in the lung and may be a useful treatment for HAPE. Following recent research, medics may also give the steroid, dexamethasone. Drug treatment should only ever be used as a temporary measure; the best treatment is descent.

4. HIGH ALTITUDE CEREBRAL OEDEMA:

High altitude cerebral oedema (HACE)

HACE is a build-up of fluid in the brain. HACE is life-threatening and requires urgent action.

What are the symptoms?

HACE is thought to be a severe form of acute mountain sickness. A severe headache, vomiting and lethargy will progress to unsteadiness, confusion, drowsiness and ultimately coma. HACE can kill in only a few hours. A person with HACE will find it difficult to walk heel-to-toe in a straight line – this is a useful test to perform in someone with severe symptoms of acute mountain sickness. HACE should also be suspected if a companion starts to behave irrationally or bizarrely.

Who gets HACE?

About 1% of people of ascend to above 3000m get HACE. The lowest altitude at which a case of HACE has been reported was 2100m. HACE can also occur in people with HAPE and vice versa. Factors that

increase the risk of HACE are similar to those for acute mountain sickness and HAPE. The faster the rate of ascent and the higher the altitude, the more likely it is that HACE will develop. HACE is thought to occur mainly in trekkers or climbers who have ignored symptoms of acute mountain sickness and climbed higher rather than staying at the same altitude or descending.

What causes HACE?

The cause of HACE remains unknown. Several factors may play a role including increased blood flow to the brain. An increase in blood flow is a normal response to low oxygen levels as the body needs to maintain a constant supply of oxygen to the brain. However, if the blood vessels in the brain are damaged, fluid may leak out and result in HACE. Although we know that reactive chemicals are released when oxygen levels are low and that these chemicals can damage blood vessel walls, it still hasn't been proven that the blood vessels in the brain are actually leakier.

How is HACE treated?

Descent is the most effective treatment of HACE and should not be delayed if HACE is suspected. A Gamow bag, or portable altitude chamber, can be used as a temporary measure and, if available, oxygen and a drug called dexamethasone should be given.

Refs: Hackett P and Roach RC. High altitude cerebral edema. HAMB 2004; 5(2):136-146

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