

Article on High Altitude Health Tips: By Dr. Sanjiv Sharma (Divisional Medical Officer) Indian Railways.

Human body, either working or exposed to working at high altitude can be hazardous.

The information provided here is designed for educational use only and is not a substitute for specific training or experience.

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 Causes Altitude Illnesses

The concentration of oxygen at sea level is about 21% and the barometric pressure averages 760 mmHg. As altitude increases, the concentration remains the same but the number of oxygen molecules per breath is reduced. At 12,000 feet (3,658 meters) the barometric pressure is only 483 mmHg, so there are roughly 40% fewer oxygen molecules per breath. In order to properly oxygenate the body, your breathing rate (even while at rest) has to increase. This extra ventilation increases the oxygen content in the blood, but not to sea level concentrations. Since the amount of oxygen required for activity is the same, the body must adjust to having less oxygen. In addition, for reasons not entirely understood, high altitude and lower air pressure causes fluid to leak from the capillaries which can cause fluid build-up in both the lungs and the brain. Continuing to higher altitudes without proper acclimatization can lead to potentially serious, even life-threatening illnesses.

Acclimatization

The major cause of altitude illnesses is going too high too fast. Given time, your body can adapt to the decrease in oxygen molecules at a specific altitude. This process is known as acclimatization and generally takes 1-3 days at that altitude. For example, if you hike to 10,000 feet (3,048 meters), and spend several days at that altitude, your body acclimatizes to 10,000 feet (3,048 meters). If you climb to 12,000 feet (3,658 meters), your body has to acclimatize once again. A number of changes take place in the body to allow it to operate with decreased oxygen. The depth of respiration increases. Pressure in pulmonary arteries is increased, "forcing" blood into portions of the lung which are normally not used during sea level breathing. The body produces more red blood cells to carry oxygen, The body produces more of a particular enzyme that facilitates the release of oxygen from hemoglobin to the body tissues.

Prevention of Altitude Illnesses

Prevention of altitude illnesses falls into two categories, proper acclimatization and preventive medications. Below are a few basic guidelines for proper acclimatization.

If possible, don't fly or drive to high altitude. Start below 10,000 feet (3,048 meters) and walk up.

If you do fly or drive, do not over-exert yourself or move higher for the first 24 hours.

If you go above 10,000 feet (3,048 meters), only increase your altitude by 1,000 feet (305 meters) per day and for every 3,000 feet (915 meters) of elevation gained, take a rest day. "Climb High and sleep low." This is the maxim used by climbers. You can climb more than 1,000 feet (305 meters) in a day as long as you come back down and sleep at a lower altitude.

If you begin to show symptoms of moderate altitude illness, don't go higher until symptoms decrease (& Don't go up until symptoms go down").

If symptoms increase, go down, down, down!

Keep in mind that different people will acclimatize at different rates. Make sure all of your party is properly acclimatized before going higher.

Stay properly hydrated. Acclimatization is often accompanied by fluid loss, so you need to drink lots of fluids to remain properly hydrated (at least 3-4 quarts per day). Urine output should be copious and clear.

Take it easy; don't over-exert yourself when you first get up to altitude. Light activity during the day is better than sleeping because respiration decreases during sleep, exacerbating the symptoms.

Avoid tobacco and alcohol and other depressant drugs including, barbiturates, tranquilizers, and sleeping pills. These depressants further decrease the respiratory drive during sleep resulting in a worsening of the symptoms.

Eat a high carbohydrate diet (more than 70% of your calories from carbohydrates) while at altitude.

The acclimatization process is inhibited by dehydration, over-exertion, and alcohol and other depressant drugs.

Preventive Medications

Diamox (Acetazolamide) allows you to breathe faster so that you metabolize more oxygen, thereby minimizing the symptoms caused by poor oxygenation. This is especially helpful at night when respiratory drive is decreased. Since it takes a while for Diamox to have an effect, it is advisable to start taking it 24 hours before you go to altitude and continue for at least five days at higher altitude. The recommendation of the Himalayan Rescue Association Medical Clinic is 125 mg. twice a day (morning and night). (The standard dose was 250 mg., but their research showed no difference for most people with the lower dose, although some individuals may need 250 mg.) Possible side effects include tingling of the lips and finger tips, blurring of vision, and alteration of taste. These side effects may be reduced with the 125 mg. dose. Side effects subside when the drug is stopped. Contact your physician for a prescription. Since Diamox is a sulfonamide drug, people who are allergic to sulfa drugs should not take Diamox. Diamox has also been known to cause severe allergic reactions to people with no previous history of Diamox or sulfa allergies. Frank Hubbell of SOLO recommends a trial course of the drug before going to a remote location where a severe allergic reaction could prove difficult to treat.

Dexamethasone (a steroid) is a prescription drug that decreases brain and other swelling reversing the effects of AMS. Dosage is typically 4 mg twice a day for a few days starting with the ascent. This prevents most symptoms of altitude illness. It should be used with caution and only on the advice of a physician because of possible serious side effects. It may be combined with Diamox. No other medications have been proven valuable for preventing AMS.

Acute Mountain Sickness (AMS)

AMS is common at high altitudes. At elevations over 10,000 feet (3,048 meters), 75% of people will have mild symptoms. The occurrence of AMS is dependent upon the elevation, the rate of ascent, and individual susceptibility. Many people will experience mild AMS during the acclimatization process. Symptoms usually start 12-24 hours after arrival at altitude and begin to decrease in severity about the third day. The symptoms of Mild AMS are headache, dizziness, fatigue, shortness of breath, loss of appetite, nausea, disturbed sleep, and a general feeling of malaise. Symptoms tend to be worse at night and when respiratory drive is decreased. Mild AMS does not interfere with normal activity and symptoms generally subside within 2-4 days as the body acclimatizes. As long as symptoms are mild, and only a nuisance, ascent can continue at a moderate rate. When hiking, it is essential that you communicate any symptoms of illness immediately to others on your trip. AMS is considered to be a neurological problem caused by changes in the central nervous system. It is basically a mild form of High Altitude Cerebral Edema (see below).

Basic Treatment of AMS

The only cure is either acclimatization or descent. Symptoms of Mild AMS can be treated with pain medications for headache and Diamox. Both help to reduce the severity of the symptoms, but remember, reducing the symptoms is not curing the problem. Diamox allows you to breathe faster so that you metabolize more oxygen, thereby minimizing the symptoms caused by poor oxygenation. This is especially helpful at night when respiratory drive is decreased. Since it takes a while for Diamox to have an effect, it is advisable to start taking it 24 hours before you go to altitude and continue for at least five days at higher altitude. The recommendation of the Himalayan Rescue Association Medical Clinic is 125 mg. twice a day (morning and night). (The standard dose was 250 mg., but their research showed no difference for most people with the lower dose, although some individuals may need 250 mg.) Possible side effects include tingling of the lips and finger tips, blurring of vision, and alteration of taste. These side effects may be reduced with the 125 mg. dose. Side effects subside when the drug is stopped. Contact your physician for a prescription. Since Diamox is a sulfonamide drug, people who are allergic to sulfa drugs should not take Diamox. Diamox has also been known to cause severe allergic reactions to people with no previous history of Diamox or sulfa allergies. Frank Hubbell of SOLO in New Hampshire recommends a trial course of the drug before going to a remote location where a severe allergic reaction could prove difficult to treat.

Moderate AMS

Moderate AMS includes severe headache that is not relieved by medication, nausea and vomiting, increasing weakness and fatigue, shortness of breath, and decreased coordination (ataxia). Normal activity is difficult, although the person may still be able to walk on their own. At this stage, only advanced medications or descent can reverse the problem. Descending even a few hundred feet (70-100 meters) may help and definite improvement will be seen in descents of 1,000-2,000 feet (305-610 meters). Twenty-four hours at the lower altitude will result in significant improvements. The person should remain at lower altitude until symptoms have subsided (up to 3 days). At this point, the person has become acclimatized to that altitude and can begin ascending again. The best test for moderate AMS is to have the person "walk a straight line" heel to toe. Just like a sobriety test, a person with ataxia will be unable to walk a straight line. This is a clear indication that immediate

descent is required. It is important to get the person to descend before the ataxia reaches the point where they cannot walk on their own (which would necessitate a litter evacuation).

Severe AMS

Severe AMS presents as an increase in the severity of the aforementioned symptoms, including shortness of breath at rest, inability to walk, decreasing mental status, and fluid buildup in the lungs. Severe AMS requires immediate descent to lower altitudes (2,000 - 4,000 feet [610-1,220 meters]).

There are two other severe forms of altitude illness, High Altitude Cerebral Edema (HACE) and High Altitude Pulmonary Edema (HAPE). Both of these happen less frequently, especially to those who are properly acclimatized. When they do occur, it is usually with people going too high too fast or going very high and staying there. The lack of oxygen results in leakage of fluid through the capillary walls into either the lungs or the brain.

High Altitude Pulmonary Edema (HAPE)

HAPE results from fluid buildup in the lungs. The fluid in the lungs prevents effective oxygen exchange. As the condition becomes more severe, the level of oxygen in the bloodstream decreases, and this can lead to cyanosis, impaired cerebral function, and death. Symptoms include shortness of breath even at rest.