ADIRONDOC # 19

High on the Hills

There are very few places in the northeast where one can hike to be more than a mile high. While there are plenty of ways in which we can get ourselves into trouble, altitude illnesses, fortunately, are not among them.

Yet, in nearly every issue of *Adirondac* I see adds and announcements of treks which will take participants well into the heights at which we need to worry about the adverse effects of altitude. Hopefully, leaders of such trips will provide their clients with up-to-date information on prevention. Just in case, I thought it might be a good idea to review the entire issue of altitude illness among hikers, when to worry about it, and how to recognize and prevent it.

I am afraid, as with many such topics, that a bit of science is needed before jumping in to this subject. All our body tissues require oxygen to fuel their activities. How much oxygen actually gets there depends upon a number of factors: the **percentage** of oxygen in air (nearly constant at 26%, no matter where one lives); the **pressure** of the air being breathed (mainly a function of altitude); the number of oxygen-carrying **red cells** in the blood; the **efficiency of the lungs** in getting that oxygen into the red blood cells; and the **efficiency of the heart** in pumping those red blood cells to the tissues. A change in any one of these factors will impair the delivery of fuel (oxygen) to the tissues.

An example of this with which we are all familiar is commercial flight. Since air pressure decreases with altitude, tissue oxygen delivery would be very poor as we jet above the clouds. To prevent this, cabins of high-flying planes are **pressurized** to counter the effect of altitude. The fallback procedure ("In the unlikely event of sudden loss of cabin pressure…") is to increase the percentage of oxygen in the air ("...oxygen masks will fall from the panel overhead."). Folks who hike, instead of flying, to high altitude cannot very well "pressurize" themselves, so the body undertakes a variety of adaptations. Breathing becomes more rapid and the heart rate increases, both in an effort to deliver more oxygen to the tissues. Over time, the body cleverly increases the numbers of red blood cells in individuals living at high altitude. Very strenuous work at high altitude can require more oxygen delivery than the body can achieve on its own—thus, the sides of Mt. Everest are littered with empty oxygen canisters!

The easiest-to-understand consequence of high altitude hiking is severe exhaustion. The amount of oxygen carried by the blood in very "thin air" may be barely enough to supply the energy to stand up and breathe, let alone hike. Above 8,000', there are measurable decreases in ability to work, and above 18,000' the simplest of tasks can be almost impossible. The great climber Reinhold Messner wrote eloquently about this phenomenon in describing his heroic oxygen-less ascent of Mt. Everest.

Persistently low tissue oxygen can eventually lead to a series of problems, together referred to as "acute mountain sickness" (AMS). AMS can cause everything from a nagging headache to sudden death from swelling of the brain or fluid build-up in

the lungs. The risk of AMS is greatest above 14,000', but can occur even just above 8,000'. Paradoxically, since vastly more people find themselves above 8,000' than above 14,000', there are actually many more cases of AMS at the lower range of altitudes—well within that seen by casual trekkers.

The likelihood of developing AMS is largely related to the rapidity at which altitude is achieved. Thus, a sea-level dweller who flies to an intermediate high altitude starting point and then begins a climb is at much greater risk than one who climbed gradually. For example, in one study about 2/3 of travelers who climbed Washington state's 14,410' Mt. Rainier, taking only one to two days, had some symptoms of AMS.

The symptoms of AMS are varied and non-specific. Often, headache, nausea, vomiting, and fatigue may be no different than one would attribute to "flu". A safe rule is that any such complaints in someone recently ascending to high altitude should be considered AMS. If improvement does not occur with rest, then immediate descent by 2,000 or more feet is recommended. Just like those with hypothermia or dehydration, patients with AMS may have impairment of judgment and decision-making. They may resist the recommendation to descend, and may require strong intervention by the trek leader.

Some expeditions have begun carrying a portable hyperbaric chamber, called a Gamow Bag, to provide pressurization to a climber when immediate descent is impractical. This device uses a foot pump to achieve pressurization. Since being

intgroduced in the late 1980s, the Gamow Bag has reportedly been used on hundreds of occasions.

Finally, a medication called acetazolamide (Diamox ®) has been shown to be very effective in preventing some of the symptoms of AMS. Travel physicians often prescribe this for patients setting off on high-altitude treks. Starting to take the drug prior to arriving at altitude is the usual routine. Although generally safe, it does have occasional unpleasant side effects, and is not appropriate for those with certain other medical conditions or those taking other specific medications. I believe it very advisable for anyone planning trips which will entail extended travel above about 8,000 feet to discuss this topic with their personal physicians or a physician experienced in wilderness or travel medicine.

For information about this or other backcountry topics, visit Dr. Welch on the web at www.adirondoc.com, or contact him at info@adirondoc.com. Information about upcoming courses he will be teaching in Alaska are also available through this website.