GETTING HIGH AND FEELING GOOD

PREVENTING AND TREATING ALTITUDE SICKNESS

BY: BRIAN IRWIN

Queue up! Twenty-six climbers near the 20,320-foot summit of Denali on June 20, 2007.

Anticipating a snail's pace, we left for the summit of Mount Rainier at 11 p.m. on our second night at Camp Muir. We had originally hoped to spend just one night at the 10,080-foot camp before continuing on, but Carolyn was exhausted. She hadn't climbed to this altitude before, so we took an extra day of rest before our summit bid. We were the first team to cross the Cowlitz Glacier and Carolyn was doing well. We veered from the standard Disappointment Cleaver route up the Ingraham Direct.

As the terrain steepened, I heard coarse wheezing behind me. Carolyn was short of breath and would occasionally cough, but she was steady with her French technique and not falling behind. As we crossed over the top of the Cleaver itself, her cough worsened. We rested, sat on our packs and drank water. Carolyn lapsed into coughing fits that dropped her to her hands and knees. My headlamp cast a beam of light across her as she coughed pink-tinged phlegm into the snow. She had developed High Altitude Pulmonary Edema (HAPE).

We skated down the Disappointment Cleaver, trying not to shower the parties below us with scree. By the time we hit the base of the ridge Carolyn was fine.

"I think I'm OK. It's just a bit of bronchitis," she said. "Let's give it a day and try again."

"No way," I said.

Seven hours later we were drinking Pabst and eating pizza in the thick air of Ashford, Washington.

MORE COMMON THAN YOU THINK

Carolyn's incident may sound like a rare occurrence, but various degrees of altitude-related illness are extremely common, and can strike anyone who ascends to altitude, from summer hikers to hardcore alpinists. In fact, one study found that over two-thirds of all climbers on Mount Rainier suffered some degree of altitude illness. Another study showed that a quarter of all "lowlanders" who visited Colorado suffered high-altitude-related symptoms. These symptoms, collectively referred to as AMS, or Acute Mountain Sickness, are generally mild. Usually, nausea, vomiting, headache and cough are as bad as it gets. AMS can progress to other life-threatening conditions, however, and needs to be recognized and treated promptly and appropriately. Here's the skinny:

HELP ME, I'M LEAKING!

Our bodies adapt fairly well to the environment they are placed in. Unfortunately, this adaptation takes time, something that doesn't always fit into the vacation schedule of someone planning a trip to the Alps or the Andes. Sherpas, for example, have significant biochemical differences that allow them to live at higher altitudes, but these differences have developed over generations.

At an altitude of 8,000 feet, the atmospheric concentration of oxygen is only 75 percent of that at sea level. On top of Mont Blanc (15,774 feet), the concentration drops to 55 percent of that at sea level. If you're climbing into air that thin, the decreased oxygen supply, in combination with lower atmospheric pressure, stresses your body, leading to an increased respiratory rate, fluid retention on a microscopic level and an outpouring of hormones that affect everything from kidney function to heart rate. The end result is some degree of "leakiness" of the blood vessels and swelling of the brain, leading to loss of appetite, nausea, headaches and fatigue. If that process continues, the swelling can become severe, leading to confusion, hallucinations, coma or even death.

Fortunately, that scenario rarely occurs, as most people take the time to acclimate, allowing the body to adjust slowly to lower atmospheric oxygen concentrations and air pressure. As soon as the body senses low blood oxygen levels, it increases its respiratory rate. Our blood not only carries oxygen, but also carbon dioxide. As we breathe faster, we expire the CO_2 delivered to our lungs by our blood. This loss of CO_2 changes the pH of the bloodstream. Over a period of days our kidneys correct this imbalance, the respiratory rate falls, and we adapt and feel better.

While that lung-kidney balancing act may keep AMS at bay in the short term, it won't turn us into Sherpas. Over weeks to months at high altitude the body slowly increases the number of red blood cells in circulation (driven by an increase in the levels of the hormone erythropoietin) and changes blood volume, heart rate and hormone levels to adapt to this new, harsh environment. Given enough time to acclimate, your body will eventually function almost as well as it did at sea level.

It's not true, however, that Sherpas or any human can acclimate to and live at any altitude. Complete acclimatization at altitudes over 18,000 feet does not occur in humans, regardless of how much time they allot. Although climbers can tolerate extended periods of time at this high altitude—during a Himalayan expedition, for example—if those climbers stay at extreme altitude for long enough (months), deterioration of body systems will occur, leading to illness and necessitating descent.

I'M NOT CLIMBING EVEREST, I JUST WANT TO BAG FOURTEENERS. HOW SICK COULD I GET?

Very. While it's true that rapid ascent to extremely high altitude, typically defined as over 18,000 feet, is almost guaranteed to give you AMS or worse, severe degrees of altitude illness can and do occur at lower altitudes. Symptoms of mild AMS have been reported as low as 6,000 feet, although such elevations are generally considered safe. AMS can occur in anyone who rapidly ascends to altitudes over 8,000 feet from an elevation 5,000 to 6,000 feet lower. The higher the altitude and the more rapid the ascent, the greater the chance you'll suffer from AMS. This certainly puts anyone traveling from 5,000 feet to climb a fourteener in a weekend at risk.

Altitude-related illness is a broad spectrum, one that can advance fairly quickly. On one end are the lucky patients who experience only mild AMS—nausea, headaches and fatigue. On the other end are patients who suffer potentially fatal conditions like

DUANE RALEIGH; COURTESY OF K2 AVIATION

swelling of the brain (High Altitude Cerebral Edema; or HACE) or fluid collection in the lungs (High Altitude Pulmonary Edema; HAPE). HACE is the most severe form of AMS. Even mild AMS can progress to HACE within 12 hours, and the condition has occurred at elevations under 9,000 feet. Typically, symptoms are subtle at first—including simple forgetfulness, confusion or irritability. If untreated, symptoms may progress to unsteadiness while walking, hallucinations, slurred speech, loss of consciousness and eventually death. HAPE can also develop rapidly, often presenting subtly with shortness of breath, cough and sometimes wheezing. If the condition progresses, fluid accumulation in the lungs, respiratory distress and even respiratory failure can occur.

PREVENTION AND TREATMENT OF AMS, HACE AND HAPE

Ascend slowly. Climbing to altitude quickly is often necessary depending on the type of climb and the style in which it is being done. While alpine style often dictates disregard of this "golden rule," that very rule will most likely prevent altitude illness. The classic recommendation for climbs to altitudes of 10,000 feet is to try and limit the ascent to 1,000 vertical feet per night of sleep. In reality, it's probably safe to climb twice that high per night, as long as extra rest nights are built in.

Climb high, sleep low is another sound adage. When you climb to a higher altitude, your respiratory rate also climbs in an attempt to compensate for the air's lower oxygen concentrations. Remember that your kidneys will need to correct the acid-base imbalance this respiratory rate generates. Correction takes time, so by descending to rest, you help your kidneys keep up with your lungs. Expedition-style climbers who ascend and then later retreat to lower camps to sleep are much less likely to run into problems.

Brew and eat. Your body can only rebalance its pH and acclimate if it's able to generate urine, so proper hydration is paramount. Over-hydration can actually worsen AMS, so don't drown yourself. Strive for clear urine.

Proper nutrition is also important to allow your kidneys to acclimate. Some studies support the benefit of a diet relatively high in carbohydrates at altitude. Carbs require less oxygen than fats or protein to metabolize and provide more rapid energy. They alleviate some of the symptoms of AMS and may actually help prevent its onset.

Descend. Nothing beats altitude-related illness like a lower altitude. Descent is the most reliable way to reverse AMS, HAPE or HACE. Often descending roughly 3,000 vertical feet from the point where symptoms began is adequate. If full recovery occurs, then you may consider resuming a very gradual ascent at a much slower pace than before. Portable hyperbaric chambers, such as the Gamow Bag provide artificial altitude reduction in emergency situations.

ALTITUDE MEDICINE CHEST

Treat your symptoms. Mild and even moderate AMS can often be managed by avoiding further ascent, being patient while the body acclimates and treating the symptoms. Have anti-nausea medications and headache-relief medications (like Tylenol) in your pack. Avoid sleep aids and narcotics. They can alter respiratory rate and sleep patterns, and even worsen AMS.

Acetazolamide. This prescription medication is actually a diuretic, which means it makes you urinate. Seems counterintuitive, but this med (also known as Diamox) actually helps your kidneys rebalance your blood's pH, speeding your breathing rate slightly and aiding in acclimatization. In multiple trials over the years, this drug has been shown to be effective at treating AMS. Many dosing recommendations exist, but 125 miligrams twice a day (in adults) is probably the most effective and is unlikely to lead to significantly excessive urination.

Oxygen. Supplemental oxygen is very effective at preventing AMS, HACE and HAPE and is most commonly used on peaks over 8,000 meters. While seldom used as a preventative option at lower altitudes, it can provide life-saving therapy for HACE and HAPE, and will eliminate symptoms of most mild or moderate AMS.

Dexamethasone. This steroid can be taken orally or by injection. It's very effective at treating AMS and is the mainstay of therapy for treatment of HACE. While it also significantly decreases the symptoms of AMS during ascent, avoid it as a preventative, because when the drug is withdrawn, AMS, and sometimes HACE, can develop very rapidly. In some special cases its use for prevention may be safe, but should be under the supervision of a physician.

Nifedipine. A blood-pressure-lowering pill, Nifedipine is primarily used for treating HAPE. It is effective in preventing this condition in patients who have had recurrent HAPE, but shouldn't be used for treatment in most other people. Nifedipine has not been found effective at prevention or treatment of HACE or AMS.

Ginkgo biloba. Initial studies on ginkgo were very promising, suggesting that the plant's ability to improve blood perfusion to the brain may decrease the incidence of AMS and may even treat HACE or HAPE. While plenty of smaller studies and anecdotal evidence support its role in preventing and treating altitude illness, more recent, larger studies have shown that ginkgo is less effective than Acetazolamide at prevention of AMS and that it is likely no more effective than a placebo.

Vinpocetine. Another herbal option, this drug is commonly used in Asia to improve brain perfusion after strokes. Its role in altitude illness is unclear, as it has not been thoroughly studied, but given its mechanism, it is a promising alternative.

L-Arginine. An amino acid, L-arginine is present in all plants and animals. While it can be taken as an oral supplement, it's also present in high levels in soy products and fermented foods like miso. It is necessary for the body to produce nitric oxide, a substance needed to dilate pulmonary arteries and prevent HAPE. Early experimental models suggest it may help this condition, but like most alternative therapies, it has not been well studied.

Sildenafil. Also known as Viagra, this drug indirectly dilates blood vessels. The drug has been shown to decrease the pressure in the pulmonary arteries of patients at altitude, one of the key mechanisms in the development of HAPE. Most studies have focused on how Sildenafil affects exercise performance at altitude. These studies are impressive, with one showing exercise improvement by 45 percent at altitude. While the medication's role in prevention or treatment of HAPE, AMS or even HACE is still undefined, it's a hopeful option. It's well tolerated with few side effects other than occasional dizziness and, conveniently, some localized swelling. In fact, Sildenafil is the only medication for altitude that may prove most useful on a rest day!

Dr. Brian Irwin is a family physician from North Conway, New Hampshire. Carolyn later recovered enough to marry him.