



AdironDoc

Backcountry Health and Hygiene

Jack Frost Nipping at Your...

Several issues back, we discussed hypothermia, one of the two cold-related environmental problems affecting backcountry users. This column appears in the prime season for the other one—frostbite—making it a good time to consider both some new concepts and some interesting history involving this disorder.

The basic science of frostbite is simple. The body's ability to keep an area of tissue warmed is overwhelmed by the cold environment and the tissue freezes. Frostbite is the actual, literal freezing of a body part. The occasional tingling of the nose, ears or fingers that follows cold exposure is a sign that the body is unhappy with the temperature, but is not true frostbite.

The key to preventing frostbite lies in understanding how it occurs. The circulation of warm blood to body parts is our major defense against the cold. Anything that impairs circulation, therefore, can promote frostbite. Smokers, diabetics and individuals with any preexisting circulatory disease may have a decreased blood flow to their fin-

gers and toes, predisposing to frostbite and its sequelae. Similarly, with dehydration the body tends to decrease blood flow to places like the arms and legs in order to maintain circulation to vital internal organs. Thus, the dehy-

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drated trekker is at greater risk of frostbite. Indeed, some experts maintain that frostbite rarely occurs in the absence of dehydration.

Moisture in the upper layers of skin promotes freezing. Thus, keeping the skin as dry as possible is another important preventive measure. With time, unwashed skin accumulates oils,

which, in the absence of water, may be protective. This is the rationale for minimizing washing while spending time in a freezing environment. Readers of Byrd's gripping narratives of his several Antarctic sojourns will be familiar with this concept.

It goes without saying that appropriate warm clothing is a critical defense. Mittens, rather than gloves, are the optimal handwear, although gloves should also be brought along for tasks requiring dexterity. Also important is a balaclava or similar apparel, both to protect the very susceptible nose and ears and, just as important, to minimize radiant heat loss from the head. Watch carefully for clothing that can be constricting—especially on the feet. By impairing circulation, such items can actually increase the danger of freezing; the toes are among the body parts most often affected by frostbite.

Heat is conducted very efficiently by metal. Direct skin-to-metal contact, such as in working with a stove, can cool tissues dangerously. Minimize such exposure by using gloves where possible and having others in the crew share the work.

For reasons that are not clear, once a part of the body has suffered frostbite, it appears to be more easily susceptible to recurrent cold injury. Therefore, particular attention must be paid to protection and observation of any such area.

Recognition of frostbite is not diffi-

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Frostbitten tissues can look absolutely ghastly for days or weeks, but ultimately recover.

cult. The affected area will generally be numb, white and hard. In some cases, blistering may be present. Black discoloration is a late finding.

Field treatment of frostbite includes some general suggestions, applicable to any situation, and then two divergent approaches, depending upon conditions. The victim must be warmed and hydrated, mainly to prevent further injury. The involved area should be covered with a sterile dressing and protected by padding from pressure and abrasion. Any break in the skin should be covered by an antibiotic ointment. A major part of the damage in frostbite results from blood clotting in the affected area; administration of a single, simple aspirin tablet may help to minimize this complication. (By the way, this is also part of the current emergency management of a suspected heart attack, for much the same reason.)

The divergent approaches come in at this point. Although the ultimate treatment of frostbite is careful thawing, whether or not this should be done in the field depends upon a number of factors. First of all, if thawing is to be undertaken it must be with the assurance that the area will not refreeze. A cycle of freezing-thawing-refreezing has been shown to be more damaging to tissue than simply staying frozen. If the frostbite involves the feet, and if the victim will need to do some walking during evacuation, thawing may best be delayed. While one can walk on a frozen foot, walking on a thawed foot is virtually impossible. Finally, proper thawing requires immersion in water of a

fairly constant temperature (38° to 42° C). Water that is much warmer than this can be very damaging to tissue. Few parties outside of major expeditions are equipped to provide large volumes of constant-temperature clean water in a container appropriate for this undertaking. Since there are few places

days or weeks, but ultimately recover. Surgeons not used to dealing with the problem may be quick to recommend amputation, when in fact some recovery is actually possible. Amputation for frostbite should almost never be an urgent undertaking. A well-known textbook of mountaineering medicine quotes the aphorism "Freeze in January; amputate in June."

Some readers may remember learning, as did I, about the dangers of rubbing frostbite with snow or ice. I was always curious about such warnings: Who in their right mind would rub frozen tissue with snow *anyway*? It turns out that not only was such advice routine in the 19th century, but it also had some rationale. During Napoleon's ill-fated siege of Moscow in the winter of 1812-1813, his troops were decimated by frostbite. It was common for the men to spend evenings around roaring campfires, thawing their frozen limbs in the heat of the flames. Of course, they would often freeze again the next day. Napoleon's chief surgeon, de Larrey, was actually the first physician to recognize that this freeze-thaw cycle was very dangerous, leading to gangrene and loss of limb or life. His recommendation was simply that if the soldiers felt the need to massage frozen areas, they do so with something cold so as not to induce thawing. While certainly not appropriate advice today, it was a major advance almost two centuries ago!

—Thomas R. Welch, M.D.



in the Northeast where evacuation for definitive care takes an inordinate amount of time, **there are probably few circumstances in our area in which field thawing is necessary.**

Once definitive medical care has been reached, there is one important "consumer warning." Frostbitten tissues can look absolutely ghastly for

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