Field Treatment

In 1957, Hurley [68] stated, “Tissue cells can be affected by freezing in three different ways: (1) a certain number of cells are killed; (2) a certain number remain unaffected; and (3) a large number are injured but may recover and survive under the right circumstances.” Clearly, the major treatment effort must be to salvage as many cells in the third group as possible. Frostbite treatment is directed separately at the pre-thaw and post-thaw intervals.

Self-Rescue in the Freezing Environment

The International Commission for Alpine Rescue (ICAR) gives specific recommendations for self-rescue to those working, recreating, or otherwise exposed to a cold environment (Box 8-1). These guidelines advise seeking shelter from cold and wind, drinking warm fluids, removing wet clothing, taking ibuprofen, and attempting self-rewarming for 10 minutes. If at high altitude, supplemental oxygen is advised, and if sensation does not return, the victim is advised to discontinue any further exposure and seek treatment. [172] Although these guidelines may seem common sense to most, climbers appreciate these guidelines for safety and self-rescue when in an exposed, potentially dangerous, and remote setting.

Box 8-1

## Guidelines From ICAR for Self-Treatment of Potential Frostbite

### Emergency Treatment

#### In the Open With Possible Onset of Frostbite

- Move out of the wind/consider turning back/drink fluids (warm if possible)
- Remove boots— but consider possible problems with replacement if swelling occurs
- Remove socks/gloves if wet. Exchange for dry clothing
- Warm by placing foot/hand in companion's armpit/groin for 10 minutes only
- Replace boots
- Give one dose of aspirin or ibuprofen to improve circulation (if available and not contraindicated)
- Don't rub the affected part because this may cause tissue damage
- Don't apply direct heat
  - If there is sensation, the victim can continue to walk
  - If there is no sensation, the victim should go to the nearest warm shelter (hut/base camp) and seek medical treatment
  - At high altitude, give oxygen if available

ICAR, International Commission on Alpine Rescue.

In the Prehospital Freezing Environment

The Alaska State guidelines for field treatment and transport of patients with frostbite recommend the following:

<table>
<thead>
<tr>
<th><strong>If transport time will be short (1 to 2 hours at most)</strong>, the risks posed by improper rewarming or refreezing outweigh the risks of delaying treatment for deep frostbite.</th>
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<tbody>
<tr>
<td><strong>If transport will be prolonged (more than 1 to 2 hours)</strong>, frostbite will often thaw spontaneously. It is more important to prevent hypothermia than to rewarm frostbite rapidly in warm water. This does not mean that a frostbitten extremity should be kept in the cold to prevent spontaneous rewarming. Anticipate that frostbitten areas will rewarm as a consequence of keeping the patient warm and protect them from refreezing at all costs.</td>
</tr>
</tbody>
</table>

The Joint Commission of Health and Human Services, emergency medical services, and public health departments for Alaska have published further guidelines for prehospital and bush clinic care of frostbite. These guidelines are widely regarded as state-of-the-art recommendations and appear in Box 8-2. If a patient is referred from a nearby location, no attempt at field rewarming is indicated. Vigorous rubbing is ineffective and potentially harmful. The extremity should not be intentionally rewarmed during transport and should be protected against slow partial rewarming by keeping the patient away from intense campfires and car heaters. All constrictive and wet clothing should be replaced by dry, loose wraps or garments. The extremity is padded and splinted for protection, and ibuprofen 400 mg twice daily (which may be more beneficial than aspirin because aspirin may block more of the inflammatory cascade than is helpful) may be initiated. Although there is a correlation between the length of time tissue is frozen and the amount of time required to thaw that tissue, there is no direct correlation between the length of time tissue is frozen and subsequent tissue damage. Still, “rapid” transport of frostbite patients (within 2 hours) is appropriate. Otherwise, rapid rewarming should be instituted (goal to see blush of rewarming and/or 15 minutes immersed in rewarming fluid) and the victim transported with protective, dry, nonadherent dressings to prevent refreezing. Appropriate and adequate analgesia should be administered (opiates either IV or intramuscularly [IM]) may be required. Blisters should be left intact. Patients with long transport times are at greater risk for (refreezing) recurrent injury. All efforts should be made to prevent subsequent refreezing, because this creates an infinitely worse result than does delayed thawing (Figures 8-14 to 8-16; Figure 8-16, online). A victim who must walk through snow should do so before thawing frostbitten feet (see Figure 8-10). During transport, the extremities should be elevated and tobacco smoking prohibited. Alcohol ingestion is contraindicated.

**BOX 8-2**

<table>
<thead>
<tr>
<th><strong>Alaska State Guidelines for Prehospital Treatment of Frostbite</strong></th>
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</thead>
<tbody>
<tr>
<td><strong>First Responder/Emergency Medical Technician—I, II, III/Paramedic/Small Bush Clinic</strong></td>
</tr>
</tbody>
</table>

**Evaluation and Treatment**

- **A** Anticipate, assess, and treat the patient for hypothermia, if present.
- **B** Assess the frostbitten area carefully because the loss of sensation may cause the patient to be unaware of soft tissue injuries in that area.
- **C** Obtain a complete set of vital signs and the patient's temperature.
- **D** Remove jewelry and clothing, if present, from the affected area.
- **E** Obtain a patient history, including the date of the patient's last tetanus immunization.
- **F** If there is frostbite distal to a fracture, attempt to align the limb unless there is resistance. Splint the fracture in a manner that does not compromise distal circulation.
- **G** Determine whether rewarming the frostbitten tissue can be accomplished in a medical facility. If it can, transport the patient while protecting the tissue from further injury from cold or impacts.
- **H** If the decision is made to rewarm frostbitten tissue in the field, you should prepare a warm water bath in a container large enough to accommodate the frostbitten tissues without them
touching the sides or bottom of the container. The temperature of the water bath should be 99° to 102° F (37° to 39° C).

- Generally, patients with frostbite do not require opiates for pain relief; they occasionally need non-opiate pain medication or anxiolytics. If possible, consult a physician regarding the administration of oral analgesics, such as acetaminophen, ibuprofen or aspirin. Aspirin or ibuprofen may help improve outcomes by blocking the arachidonic acid pathway.

- Immersion injury or frostbite with other associated injuries may produce significant edema and high pain levels. These patients may need opiate pain medications for initial treatment. In this case, advanced life support personnel should administer morphine or other analgesics in accordance with physician-signed standing orders or online medical control.

I A source of additional warm water must be available.

J Water should be maintained at approximately at 99° to 102° F (37° to 39° C) and gently circulated around the frostbitten tissue until the distal tip of the frostbitten part becomes flushed.

K Pain after rewarming usually indicates that viable tissue has been successfully rewarmed.

L After rewarming, let the frostbitten tissues dry in the warm air. Do not towel dry.

M After thawing, tissues that were deeply frostbitten may develop blisters or appear cyanotic. Blisters should not be broken and must be protected from injury.

N Pad between affected digits and bandage affected tissues loosely with a soft, sterile dressing. Avoid putting undue pressure on the affected parts.

O Rewarmed extremities should be kept at a level above the heart, if possible.

P Protect the rewarmed area from refreezing and other trauma during transport. A frame around the frostbitten area should be constructed to prevent blankets from pressing directly on the injured area.

Q Do not allow an individual who has frostbitten feet to walk except when the life of the patient or rescuer is in danger. Once frostbitten feet are rewarmed, the patient becomes nonambulatory.


FIGURE 8-14  
A, Day 2 after exposure: field rewarming of frostbite injury to Mt Everest summiteer at 6400 m (20,997 feet); B, day 3: field treatment of frostbite injury at 5300 m (17,388 feet) (Courtesy Christopher H.E. Imray, MD.)
The Wilderness Medical Society convened a panel of experts to review recent literature and ICAR and Alaska State guidelines in order to apply evidence grades based on the quality of supporting evidence, and balance between the benefits and risks for each modality according to methodology stipulated by the American College of Chest Physicians. A document of these graded
guidelines is projected to be published in 2011.

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