# MOUNTAIN TRAVEL & RESCUE

**NATIONAL SKI PATROL'S MANUAL FOR MOUNTAIN RESCUE**

2ND EDITION

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THE MOUNTAINEERS BOOKS
is the nonprofit publishing arm of The Mountaineers,
an organization founded in 1906 and dedicated to the exploration,
preservation, and enjoyment of outdoor and wilderness areas.

1001 SW Klickitat Way, Suite 201, Seattle, WA 98134



First edition 1995. Second edition 2012.



Distributed in the United Kingdom by Cordee, www.cordee.co.uk

Manufactured in the United States of America

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Cover photograph: Anton Art/Alamy

*Library of Congress Cataloging-in-Publication Data*
National Ski Patrol System (U.S.)
Mountain travel and rescue : a manual for basic and advanced mountaineering courses / National Ski Patrol System, Inc. — 2nd ed.
p. cm.
Includes bibliographical references and index.
ISBN 978-1-59485-708-9 (ppb)
1. Ski patrollers—United States. 2. Skiing accidents—United States. 3. Skiing injuries—United States. I. Title.
GV854.N34 2012
617.1'0276522—dc23
2012025375

ISBN (paperback): 978-1-59485-708-9
ISBN (e-book): 978-1-59485-709-6



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133 South Van Gordon Street, Suite 100
Lakewood, Colorado 80228
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www.nsp.org

National Ski Patrol System, Inc. is a federally chartered educational association serving the ski and outdoor recreation community by providing exceptional education programs.

CHAPTER 14

# BACKCOUNTRY MEDICAL

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OBJECTIVES

- Explain the differences between providing emergency medical care in a backcountry setting versus a serviced ski area or other accessible location.
- Describe what high-altitude illness is and how it can be treated in the backcountry.
- Explain some of the symptoms of both heat-related illness and cold-related illness.
- Describe the more common traumatic injuries that occur in the backcountry.
- List a few of the items that can be used for improvised splints and stabilization devices when treating fractures and other injuries.

Injuries and accidents that occur in the backcountry can be especially challenging because access to medical care may be very limited or nonexistent. In addition the mountain environment may worsen pre-existing medical conditions or predispose some backcountry recreationists to specific medical problems.

It is important that those entering the backcountry anticipate medical situations and prepare accordingly. This preparation should consist of the following:

» Taking steps to prevent injury or illness
» Contemplating means of addressing various injuries or illnesses

» Determining how evacuation of a patient may be accomplished

It is impossible to prepare for every possible situation and it is impractical to pack enough equipment for all potential scenarios, so improvisation is emphasized in backcountry settings. Outdoor Emergency Care (OEC) technicians are well trained in the use of dedicated splints, dressings, and patient packaging; however, in the wilderness such equipment is often unavailable. Instead rescuers should use their training to utilize whatever materials are available.

This chapter is not meant to be comprehensive but serves as a supplement to prior medical training by shifting the focus from the acute "stabilize and transport" model to the real possibility of an extended evacuation where advanced medical care is several hours to days away. An understanding of pathophysiology—that is, the functional changes associated with an illness or injury—allows the rescuer to better treat a patient in a wilderness setting. Recognize that the following information is condensed. More complete explanations can be found in the fifth edition of the National Ski Patrol's *Outdoor Emergency Care* manual. Additionally, understand that the following techniques are meant as examples of treating backcountry patients and may not be the preferred treatment for all situations.

A rescuer should not provide care beyond his or her level of training. Be aware, too, that administering any medication beyond oxygen is outside OEC treatment guidelines. Ethical exceptions to this rule will undoubtedly arise in the backcountry and should be dealt with cautiously. Some of the content of this chapter exceeds the scope of practice of an OEC technician and is provided for background information only.

## ASSESSMENT

No matter what the illness, emergency, or accident, proper assessment is essential to a successful rescue.

The primary assessment of an accident scene and initial patient assessment are extremely important in the timely triage, care, and rescue of patients in the outdoor environment. Good patient care is directly linked to good patient assessment.

When approaching the scene of an accident, the first step of the assessment process is scene size-up consisting of four components:

1. Scene safety. Determine that rescuer and patient are not in danger.
2. Mechanism of injury. Determine how the illness or injury occurred.
3. Total number of patients involved. In a multiple-patient accident, triage may be necessary to determine who

is to be cared for first. Immediate care is determined by the ABCs: airway, breathing, and circulation.

4. Need for additional resources. Assess how badly injured the patient is, and decide if additional help is needed.

## HIGH-ALTITUDE ILLNESS

Unique to those involved in mountain travel and rescue are medical issues concerning the effects of altitude on the human body. Ascents to altitudes above about 7,000 feet may result in high-altitude illness.

High-altitude illness is caused by a lack of oxygen because of a lower barometric pressure at high altitude. Cold, fatigue, and dehydration may play a role. Individuals vary in their tolerance to high altitude.

The best predictor of who will get high-altitude illness is a prior history of the condition during similar rates of ascent to similar altitudes. In general, risk of altitude illness increases with faster rates of ascent to higher altitudes. Some people can reach very high altitudes with little or no distress, while others become ill at moderate altitudes.

Symptoms can occur in people who fly or drive from low to high altitude, and in those who travel to high altitude under their own power. Symptoms may come on rapidly, and they usually disappear quickly upon descent, or slowly during one or two days at the same altitude as acclimatization occurs. Rest, over-the-counter analgesics (ibuprofen and acetaminophen) for headache, hydration (but not forced overhydration), and a light diet are helpful. Oxygen is useful but generally unnecessary.

### ACUTE MOUNTAIN SICKNESS

The most common form of high-altitude illness is acute mountain sickness (AMS). Acute mountain sickness can occur within hours of ascending to high altitude. Predisposing factors to AMS include a too-rapid ascent and a prior AMS history. Children and adolescents seem to be more susceptible than older individuals.

#### *AMS signs and symptoms*

AMS symptoms may mimic other general ailments, initially misleading companions about a person's condition. Some of the signs of AMS include the following:

- Generalized throbbing headache that's worse at night and when bending over
- Apathy, weakness, and fatigue
- Lightheadedness
- Loss of appetite, nausea, and vomiting
- Insomnia

Additionally, periodic breathing during sleep, known as Cheyne-Stokes respirations, may develop and are characterized by intermittent periods of alternating deep and shallow breathing during which the patient may stir or awaken with a sense of suffocation.

Symptoms appearing early on the first day of attaining altitude are more likely to be caused by mild AMS. A day or two of rest at the same altitude without ascending any higher may be appropriate. If symptoms worsen with rest, descent should be considered. If confusion or ataxia (the loss of muscle coordination) develop, immediate descent is mandatory. Do not ascend in the face of persistent AMS symptoms.

Headache should be treated with a nonprescription medication such as acetaminophen, ibuprofen, or aspirin. A number of prescription medications are available that have some value in the prevention and treatment of AMS but do not replace descent. A drug called acetazolamide (Diamox) can prevent the condition but requires a prescription from a physician. It is recommended for people who have a recurrent history of AMS during prior similar ascents to high altitude. Acetazolamide also effectively eliminates periodic breathing during sleep at high altitude.

Signs and symptoms of AMS that mandate immediate descent include any of the following:

» Ataxia
» Altered level of consciousness
» Respiratory distress associated with persistent cough and gurgling in the chest
» Inability to eat or drink due to nausea, and vomiting that lasts for more than a few hours

Descent should be at least 3,000 feet below the altitude where symptoms began. The group should descend early while the patient can still walk. If the patient can no longer walk, the rescuers should carry him in a sitting or upright position. If the patient becomes unresponsive, care must be appropriately provided.

These guidelines are not absolute. If there is any question about whether to evacuate, always evacuate. The risk of severe, advanced altitude illness is quite low after the fifth day at altitude, but symptoms can still be precipitated by stressors such as swimming in a cold stream, a hard fall, hypothermia, or a respiratory infection.

### *Assessing AMS*

When assessing AMS, the rescuer should

» consider AMS in anyone who is not feeling well at altitudes of 7,000 to 8,000 feet or above.
» assess vital signs, especially the pulse and respiratory rate, and compare these with other members of the party.
» carefully question the patient about headache, nausea, vomiting, and shortness of breath.
» assess the level of responsiveness; if it is decreased, assess ability to move and the patient's perception of pain and touch.
» listen for abnormal lung sounds such as wheezes and crackles.
» assess for ataxia and mental alertness.

### *AMS emergency care*

The most common practical problem is distinguishing mild AMS from moderate and severe AMS. Mild AMS may improve with rest alone if the ascent is halted. Those with moderate and severe AMS require immediate evacuation to a lower altitude.

## HIGH-ALTITUDE PULMONARY EDEMA AND HIGH-ALTITUDE CEREBRAL EDEMA

Two more serious types of high-altitude illness are high-altitude pulmonary edema (HAPE) and high-altitude cerebral edema (HACE). Severe high-altitude illnesses—HAPE and HACE—appear following a lag period of 6 to 96 hours after ascent. This is due to the effect of continued hypoxia, a deficiency of oxygen in the lungs and brain causing increases in circulatory pressure that leads to blood vessel damage, swelling, and edema. In the lungs these changes cause some of the alveoli to fill with fluid, leading to life-threatening HAPE. In the brain, generalized swelling and increased intracranial pressure can lead to life-threatening HACE. High-altitude pulmonary edema is more common than HACE and occurs after acute ascent to sleeping altitudes above about 8,000 feet. High-altitude pulmonary edema is more common in the winter months and typically affects males who have ascended from low altitude to over 8,000 feet rapidly. High-altitude cerebral edema generally occurs at higher sleeping altitudes above about 10,000 feet, but it can occur as low as 8,000 feet.

### *HAPE signs and symptoms*

Early signs and symptoms include the following:

- Persistent cough
- Respiratory distress that is worse with exertion
- Increased pulse and respirations
- Weakness
- Noticeably decreased exercise capacity

Late signs and symptoms:

- Cyanosis, or bluish skin coloration due to poor circulation
- Cough that produces large amounts of frothy, pink sputum
- Rapid pulse and respirations
- Crackle sounds in lung
- Severe respiratory distress
- Severe inability to exercise

### *HACE signs and symptoms*

Early signs and symptoms are the same as AMS, plus the following:

- Ataxia
- Confusion, progressing to stupor, coma, and, in some circumstances, death

The biggest impediments to early recognition of HAPE and HACE are their insidious onsets. Early signs and symptoms

frequently go unrecognized or are ignored by patients and their companions, who also may be suffering from some degree of AMS. By the time a serious problem is suspected, nightfall or bad weather may preclude evacuation to a lower altitude. It is also important to recognize that HAPE and HACE may occur together; hypoxia caused by pulmonary edema can contribute to the worsening of cerebral edema.

### *Emergency care of HAPE and HACE*

It is important that group members have an awareness of HAPE and HACE so that the ailment can be addressed:

» Recognize the problem and descend.
» Provide supplemental oxygen if it is available.
» Give care for unresponsiveness.

Descent is the primary treatment for HAPE or HACE. Usually a descent of about 3,000 feet results in marked improvement in symptoms. If symptoms persist, keep descending until they resolve.

## HEAT-RELATED ILLNESSES

The body has many complicated regulatory mechanisms to maintain a normal body temperature of 98.6 degrees F. The two most efficient mechanisms are evaporative cooling by sweating and radiation by a dilation of cutaneous blood vessels. It is possible to suffer from heat-related conditions even while traveling in winter and in relatively mild mountain climates.

In the backcountry, individuals may suffer from one of two types of heat-related conditions: heat exhaustion and, less often, heat stroke. The more serious of the two, heat stroke is differentiated from heat exhaustion by persistent profound mental status changes, shock, and profound elevations in temperature. When there is doubt about whether a patient has heat exhaustion or heat stroke, treat it as heat stroke.

### HEAT EXHAUSTION

Heat exhaustion occurs after exposure to a hot environment, especially when exercising. It is characterized by exhaustion, dizziness, nausea, headache, leg cramps, excessive sweating, and decreased urine output, but body temperature is less than 104 degrees F and level of responsiveness is normal or mildly confused. The body loses too much water and too many electrolytes through heavy sweating, resulting in hypovolemia. The body responds rapidly to treatment, and mental status changes do not persist or worsen.

### HEAT STROKE

Heat stroke is a life-threatening emergency identified by a decreased level of consciousness and a body temperature greater than 104 degrees F. Shock follows with dysfunction of the organ systems such as the brain, the heart and blood vessels,

the liver, and the kidneys. Untreated heat stroke results in death.

Symptoms include a fast heart rate, high respiratory rate, and decreased sweating. Unlike during heat exhaustion, the patient has a decreased level of consciousness that persists or worsens, which should prompt immediate treatment and evacuation.

Recovery from heat stroke depends on the duration of the hyperthermia, or elevation of core body temperature and the speed with which treatment is administered. Emergency treatment should begin immediately in the field and has one objective: Lower the body temperature by any means available.

Take the following steps when treating a patient with heat stroke:

» Move the patient promptly from the hot environment to a cool environment.
» Shade from direct sunlight.
» Remove clothing.
» Keep exposed skin wet with continuous air flow on it.
» Immerse patient in cold water.
» Provide supplemental oxygen.

If possible check the patient's temperature frequently to determine if the body temperature is cooling. When the core body temperature reaches approximately 101 degrees F, taper off the cooling efforts; rapid cooling below this point may lead to shivering (which will generate heat). If the patient returns to a level of responsiveness appropriate for oral hydration, give fluids. Anti-fever medications such as aspirin or acetaminophen are not helpful. Rapid evacuation is indicated. Monitor carefully for rebound temperature increase.

## COLD-RELATED ILLNESSES

Just as heat-related illnesses can strike in cold winter environments, cold-related illnesses can afflict those traveling in hot weather. Continued submersion in cold water can be as dangerous as prolonged exposure in freezing weather.

### HYPOTHERMIA

Hypothermia refers to cooling of the central part of the body to a core temperature below 95 degrees F as determined by a core thermometer. Factors that control hypothermia are discussed in Chapter 1, Body Temperature Regulation, while this chapter focuses on recognizing hypothermia and providing early emergency care.

Hypothermia can occur at temperatures above and below freezing. The combination of cold wind and water is especially dangerous. The initial drop of one to two degrees triggers shivering, followed by clumsiness, falling, slow reactions, mental confusion, and difficulty speaking. When body temperatures fall below 90 degrees F shivering gradually ceases, muscles become more rigid, and breathing and pulse rate slow. The patient gradually

becomes unresponsive and death may occur at body temperatures below 80 degrees F.

When the body is too cold to be capable of shivering, it cannot warm itself without outside help. The most common cause of death from hypothermia is ventricular fibrillation, which can be spontaneous or precipitated by jarring a hypothermic patient. A patient with severe hypothermia may appear to be dead if the pupils are fixed and dilated, pulse and breathing become undetectable, and body rigidity develops. However, the patient still may be saved with proper emergency care. That's why the dictum, "No one is dead until warm and dead" emphasizes that all patients with hypothermia deserve an attempt at rewarming.

### *Classification of hypothermia*

Hypothermia is commonly divided into two classifications: primary and secondary. Primary hypothermia occurs due to environmental exposure and is sub-divided into immersion hypothermia and non-immersion hypothermia, which occurs due to exposure to a cold environment. Secondary hypothermia is frequently associated with traumatized or critically ill patients.

Once the underlying cause of hypothermia is determined, it can be categorized based on the patient's core temperature:

» Mild hypothermia: 95 to 90 degrees F
» Moderate hypothermia: 90 to 82 degrees F
» Severe hypothermia: less than 82 degrees F

### *Assessing hypothermia*

Hypothermia should be suspected when a companion shivers, appears clumsy, stumbles, drops things, has slurred speech, or lags behind. Any person who is found ill, injured, or unresponsive outdoors in cold weather or who is removed from cold water should be considered hypothermic until proven otherwise.

**Primary survey.** The rescuer should assess the patient's level of responsiveness (LOR), airway, breathing, circulation (ABCs), and should look for obvious injury. Remember that with hypothermia the pulse may be weak and very slow, and the patient may be breathing only a few times a minute. Do not start CPR prematurely.

If a thermometer is available, take the patient's temperature. Accurate diagnosis depends on core temperature, measured rectally; however, it is not always possible to obtain a core temperature. Oral temperature may be substituted if the patient is responsive. The thermometer should be left under the tongue for a minimum of three minutes.

**Secondary survey.** The first priority is to stabilize the body temperature. Additionally, rewarming methods can be quite limited in the backcountry but may include the following:

» Get the patient out of the weather and to shelter.
» Examine the patient from head to toe, looking for injury or bleeding.
» If the patient's clothing is wet, gently exchange it for dry clothing.
» Avoid unnecessarily handling the patient. It may be better to cut off wet clothing than to undress a profoundly hypothermic patient.
» If clothing is wet and no dry clothing is available, remove the wet clothing and place the patient in a sleeping bag. Alternatively, place a blanket or spare clothing over and under the patient, cover the patient's head, and wrap them in something windproof.
» Use body-to-body contact to rewarm the patient by having one or two rescuers get into a sleeping bag with the patient with as much skin-to-skin contact as possible.
» Fill water bottles or water bladders with hot water. Wrap the containers to protect the patient's skin then apply them to the patient's armpits, neck, and groin while the patient is in a sleeping bag. Note: Chemical heat packs are NOT effective for rewarming hypothermia but if placed in the patient's hands and around the feet, they may help prevent frostbite.
» Place hot rocks wrapped in clothing in a sleeping bag with the patient.
» Treat dehydration with warm fluids if the patient is able to swallow.
» Don't allow the patient to sit, stand, or walk until he or she has been rewarmed.
» Light a stove or build a fire.

### *Emergency care of a hypothermia patient*

The principles of emergency care are to

» prevent further heat loss.
» rewarm the patient as safely as possible.
» rewarm the body core first, prior to surface warming.
» treat the patient gently to avoid precipitating ventricular fibrillation.
» treat any injuries.

The application of these principles depends on the patient's condition, the equipment available, and the presence or absence of complicating factors such as other illnesses or injuries. If a thermometer is not available, the patient is considered to have a core temperature of 90 degrees F or above if he is still shivering and capable of appropriate actions such as zipping a parka. The core temperature is likely below 90 degrees F if the patient is no longer shivering and has an abnormal mental status.

Rewarming a moderate to severely hypothermic patient in the backcountry may not be possible with the equipment available. Therefore, gently transporting the patient rapidly to medical care while instituting the above field rewarming measures is recommended. Before trans-

port the patient should be stable, fractures should be splinted, and other injuries treated using standard methods. A rapid transportation method such as a helicopter is preferable to a long, bumpy, toboggan or snow vehicle ride.

If a patient with profound hypothermia cannot be evacuated, help should be requested and rewarming started in a tent or snow shelter. The best method is probably body-to-body contact and hot water bottles in a sleeping bag.

## FROSTBITE

Frostbite, the freezing of a body part, occurs when the heat produced by the part, the heat carried to it by the blood, and the amount of covering insulation are insufficient to prevent body temperature from dropping below the freezing point of body tissue, which is about 24.8 degrees F. The amount of total damage depends on the extent and duration of freezing at the tissue level.

Certain body tissues, such as the hands, feet, ears, cheeks, and nose, have a higher risk of frostbite than others. Factors that contribute to the development of frostbite are related to the restriction of peripheral circulation and include the following:

- Fatigue
- Poor nutrition
- Alcohol
- Tobacco and/or drug use
- Arteriosclerosis, or hardening of the arteries
- Tight clothing

Inadequate insulation, wet clothing, and contact with metal or highly volatile liquids such as gasoline can also contribute to frostbite.

As frostbite thaws, the appearance of the injured part depends largely on the degree of blood vessel injury (Figure 14-1). When vessel injury is limited to minor damage, plasma, but not red cells, leaks out into the surrounding tissues, causing edema in mild cases and large blebs and blisters containing pale or yellow fluid in more extensive cases. More severe vessel injury allows red cells to leak out as well, producing smaller blisters containing dark reddish or purple fluid. When there has been extensive spasm and clotting, very little blood can reenter the injured area. Blisters are small or absent, and the tissues quickly die.

### *Frostbite types*

For backcountry medical purposes the most useful rating is the simplest.

**First-degree, or superficial, frostbite,** also called frost nip, is the mildest form and presents with numbness and erythema, or reddening of the skin. A white or yellow, firm, slightly raised plaque develops in the area of injury. Mild edema is common.

**Second-degree frostbite** results in blisters and swelling appearing at the site, surrounded by erythema and edema.

**Third-degree, or deep, frostbite** is a much more serious injury because of the danger of tissue death. It commonly involves the hands and feet and creates deeper blisters. It should be suspected if a painfully cold part suddenly stops hurting when it obviously is not getting warmer. The affected part is cold, hard, and numb, with pale, waxy skin. Hypothermia typically accompanies third- and fourth-degree frostbite.

**Fourth-degree frostbite** extends completely through the skin and involves deeper tissues, with cell death extending into muscle and to the level of bone.

### *Backcountry frostbite treatment*

The best field care for a patient with frostbite is evacuation to medical care—as fast and as safely as possible. Rewarming should not be attempted if the extremity

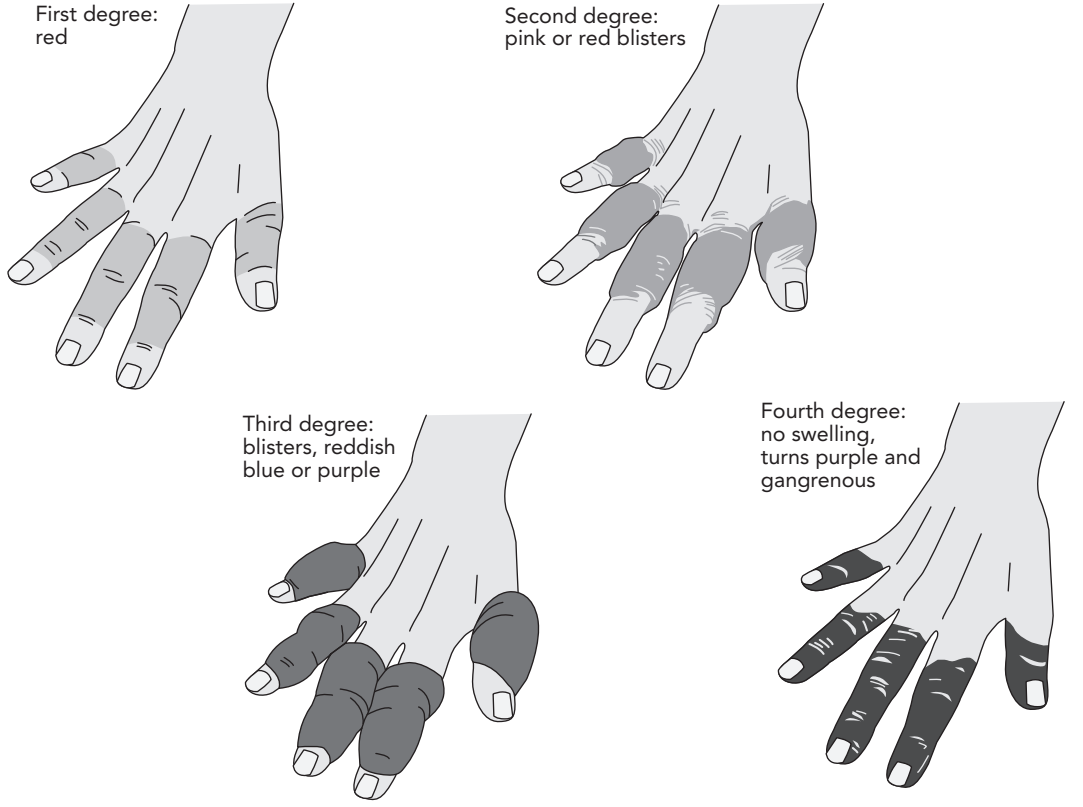


**Figure 14-1.** *Categories of thawed frostbite*

has already rewarmed spontaneously, if there is not proper equipment or proper shelter, or if medical care can be obtained soon. Conversely, rapid field rewarming may be advisable if equipment and shelter are available, if the patient can be carried out or evacuated by vehicle or toboggan, and if there is a good chance the part can be protected from refreezing during evacuation.

Rewarming should be done only in a sheltered area where the patient's entire body can be kept warm. One of the worst things that can happen to a frostbitten part is for it to refreeze after thawing. Therefore, it should be protected against refreezing by all means. For a patient who can be transported to medical care, thick layers of sterile dressings should be applied. The rescuer should leave blisters unopened, separate digits with soft cotton or wool pads, and elevate the part to reduce swelling.

## BURNS

Caring for burns largely depends on their degree (Figure 14-2). Whether caused by a camp stove or outdoor elements, painful burns acquired in the backcountry generally need to be addressed prior to a physician's consultation.

### THERMAL BURNS

Burns are very common and are among the most serious and painful of all injuries. Backcountry recreationists are susceptible to thermal burns from cooking stoves, lanterns, and fires. Upper airway burns can also occur, particularly in enclosed spaces, so assessment of the patient's airway is critical.

Keep these tips in mind when caring for burns:

» Stop the burning process and prevent additional injury.

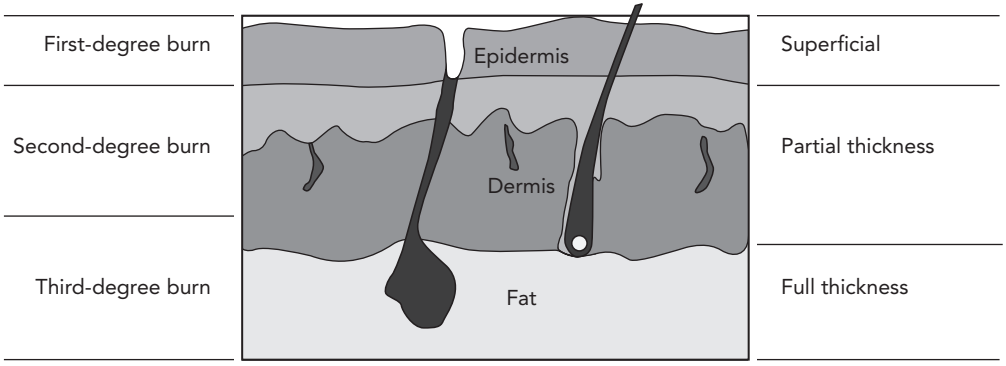


**Figure 14-2.** *Burns are classified according to their depth.*

» Immerse the burn area in cool, sterile water or saline solution; however, do not immerse the affected area for longer than 10 minutes as this can increase the risk of infection and hypothermia.
» An alternative is to irrigate the area and apply a sterile dressing.
» Prevent heat loss to avoid hypothermia.

### *Sunburn, windburn, and snow blindness*

Humans are more vulnerable to the harmful effects of solar radiation when at high altitudes, on snow, or on bodies of water. Injury to the skin and eyes can also occur on cloudy days when people forget to protect themselves.

**Sunburn.** Sunburn is a first- or second-degree skin burn. Repeated sun exposure over many years may lead to chronic degenerative skin changes such as wrinkling, thickening, and cancer. Avoiding excessive sun exposure and using proper skin protection, such as clothing or topical sunscreens, can delay these effects.

Sunscreen preparations with a high (at least 30) sun protection factor (SPF) are recommended. Because sunscreens with a cream or grease base are better at preventing frostbite and windburn than alcohol-based preparations, they are preferable for use by skiers, high-altitude climbers, and others exposed to cold, wind, and sunlight. Sunscreen should be applied 15 to 30 minutes before sun exposure and reapplied several times during the day, particularly if sweating is heavy.

Care for sunburn by removing the patient from exposure and applying cool compresses. Later, soothing ointments are useful to control discomfort. A physician should be consulted if the sunburn is extensive or if the skin is blistered.

**Windburn.** Windburn is an irritation of the skin that resembles first-degree sunburn. It can be prevented to some extent by wearing a face mask or by applying a greasy sunscreen. Treat windburn by applying soothing, greasy ointments or lotions.

**Snow blindness.** Snow blindness, or sunburn of the conjunctiva of the eye, can be prevented by wearing dark sunglasses or goggles. Because radiation can reach the eye by reflection from the snow, sunglasses should have extensions on each side and below, as found on glacier sunglasses.

Symptoms of snow blindness develop 6 to 12 hours after exposure. The eyes feel irritated (a sensation similar to "sand in the eye") and are sensitive to light. The conjunctivae are reddened, and there may be excessive tearing and swelling around the eye, as well as pain with eye motion.

Emergency care includes covering the eyes or moving the patient to a darkened area, applying cool compresses, and using nonprescription pain relievers. In severe

cases the patient should see a physician as soon as possible; medication may be prescribed to relieve the pain and speed healing.

## TRAUMATIC INJURIES

Mountain travel exposes adventurers to a wide range of traumatic injuries. In the backcountry, where advanced medical care is often hours and miles away, rescuers need to modify their training in order to provide the most effective support to the sick and injured. The following information serves as a supplement to *Outdoor Emergency Care,* fifth edition, which should be consulted for further detail.

Some of the more common backcountry injuries include the following:

- Blisters
- Strains/sprains
- Dislocations
- Fractures
- Head/neck/spine injuries
- Bleeding
- Internal injuries

### BLISTERS

Blisters develop when skin is subjected to increased friction caused by activities such as hiking in ill-fitting boots, rowing a boat, or climbing. When the skin is subjected to excess rubbing, irritation occurs and creates what is often termed a "hot spot." This is an important sign to recognize, because if left unaddressed a hot spot may become a blister. Early recognition of a potential blister or hot spot should be a catalyst for applying dressings to shield the skin from the friction before the hot spot becomes a full-blown blister. Moleskin is most often used to cover the hot spot, but simple duct tape may also work.

When treating a blister,

- clean the area well.
- drain the blister using a sterilized knife or pin by carefully puncturing the roof of the blister near the edge.
- bandage the area sufficiently to prevent infection and further damage.

### STRAINS AND SPRAINS

Strains—stretching or tearing of muscle or tendons—are commonly associated with pain and bruising at a site remote from a joint. Treatment for strains consists of RICE:

- Rest
- Ice
- Compression
- Elevation

Typically strains do not require immobilization other than for comfort.

Sprains—stretching or tearing of ligaments surrounding joints—are categorized into three grades:

**Grade 1, or minor sprains,** have little to no swelling but may be painful. These can be treated with RICE.

**Grade 2, or partial-tear sprains,** often present with swelling, pain, and discoloration. These injuries may require at least initial immobilization in addition to RICE.

**Grade 3, or complete tear sprains/strains,** typically are quite swollen and discolored. The pain may be out of proportion to the injury, or may be nonexistent. The affected joint requires immobilization.

### DISLOCATIONS

It is important that a thorough assessment is done to ensure the injury is a dislocation and not a fracture. Current OEC protocol is to treat any dislocation like a fracture. In general, do not attempt to relocate a dislocated joint unless you are familiar with proper relocation techniques.

### FRACTURES

A fracture in the wilderness presents a unique problem as only rarely can the patient reach definitive medical care within the "golden hour." This requires the rescuer to complete a thorough assessment, including the patient's vital signs, to monitor for signs of shock. In most situations it is advisable to treat the patient for shock as soon as possible.

The general approach for splinting a fracture is to re-create the fractured part's function. For a long bone this means to splint to the joint above and below the fractured bone, re-creating the stability the bone would provide. Similarly, for a fracture near a joint the splint should extend to the bones above and below the injured joint to re-create the role of the joint, which is to connect those two bones. Use whatever materials are available to accomplish this goal, such as branches, tent or ski poles, and sleeping pads.

In two particular fractures—a mid-shaft femur fracture and a cervical spine fracture—traction should be employed whenever re-aligning a fracture and should be maintained by appropriate splinting. There are many objects that can be used for improvising a femoral traction splint, such as paddles, poles, or tree branches (Figure 14-3). These general steps are similar to applying a commercially produced traction splint.

The following describes an improvised traction splint for a mid-shaft femur fracture:

- One rescuer maintains manual traction.
- The other rescuer sizes the improvised splint to the uninjured leg, preferably at least 12 inches beyond the foot.
- Using padding, pass a strap under the injured leg at the groin and affix to one end of the splint.
- Apply an ankle hitch to the injured leg.
- Tie a small rope on the distal end of the splint and pass it through the ankle hitch.

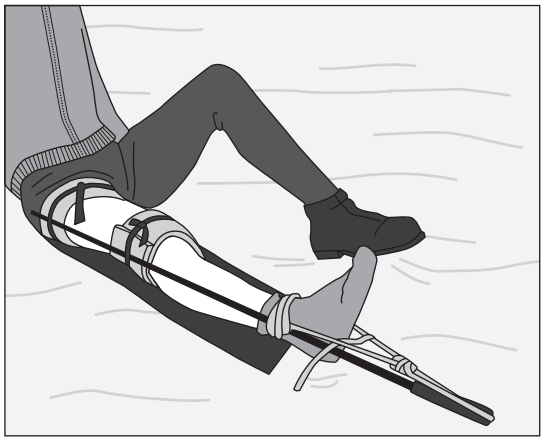

**Figure 14-3.** *Improvised traction splint*

» Pull tension on the rope until traction is transferred from the rescuer to the splint and the rope is tied off.
» Bandage the leg to the splint in three to four places.
» Reassess distal circulation, sensation, and motor function.

## HEAD, NECK, AND SPINE INJURIES

An overlooked spinal fracture may result in permanent loss of limb function or, in the case of a cervical fracture, death from pulmonary failure. However, in the backcountry it is rare that a backboard, C-collar, and head immobilization device are available, making it necessary to improvise a spinal stabilization system (Figure 14-4). Improvised C-collars do not provide as much stabilization as commercially manufactured ones but are essential if a neck injury is suspected, even if they only remind the patient to not move her neck.

Follow this procedure to make a C-collar using a SAM splint:

» Maintain C-spine stabilization.
» Place two to three bends in the SAM splint.
» Pass the splint behind the patient's neck and cross it over the chest.
» Bend the two ends of the SAM splint over each other, "locking" the splint on the neck.
» Flare out the long edges of the SAM splint for comfort and to avoid constriction of the airway.
» Bend the SAM splint further, tightening the splint in place.

Another way of improvising a C-collar is by using a rolled blanket or sweatshirt, but this method provides less stabilization.

**Figure 14-4.** *C-collar using a SAM splint*

Improvised backboards can be integrated into a litter, and once the patient is secured with a C-collar in place the head can be strapped down using tape and rolled clothing to complete spinal immobilization.

The likelihood of a spinal injury and/or a fracture should be evaluated in every patient. Assessment of these injuries is critical because relegating a previously ambulatory patient to a litter increases evacuation time and potentially exposes both patient and rescuers to increased hazards. In remote settings the following guidelines can be considered.

Patients not requiring cervical spine immobilization in a backcountry setting are characterized by the following:

» Age under 65 years
» Less significant mechanism of injury
» Normal level of consciousness
» No significant painful, distracting injury
» No weakness, numbness, or tingling
» No spinal column tenderness

Patients requiring cervical spine immobilization in a backcountry setting are characterized by the following:

» Age 65 years or older
» Dangerous mechanism of injury
» Altered level of consciousness
» Numbness or tingling in extremities
» Pain or tenderness over the spinal column

These criteria should not be used to prevent the application of a C-collar and backboard. Rather they should be employed to aid in the decision to determine the method of evacuation. Other information obtained from the patient assessment should be taken into account when making this decision. If there is uncertainty about whether to immobilize the patient, it is best to err on the side of caution while realizing that such an action will likely make evacuation significantly more difficult.

Little can be done in the backcountry setting to treat internal head injuries. Close monitoring can help determine if a head injury is a concussion or if it may progress to an intracranial hemorrhage. Patients whose mental status improves following the injury may have a concussion and should be monitored. In these patients it is important that they do not re-concuss their heads as this may result in long-term symptoms. For patients whose mental status is worsening or does not improve, an intracranial hemorrhage should be suspected. Field treatment should include elevating the head, administering oxygen if available, and evacuating the patient rapidly.

### BLEEDING

The first priority with a bleeding injury is to stop the bleeding by applying direct pressure, elevating the wound, applying pressure to a pressure point to occlude blood flow, and, in rare situations, applying a tourniquet.

## CPR IN THE BACKCOUNTRY

In an initial patient assessment, an injured or ill patient may be found without signs of life or may progress to cardiopulmonary arrest. Initiation of cardiopulmonary resuscitation (CPR) in a backcountry setting has unique implications for rescuers.

The following considerations can help determine whether CPR should be initiated in the backcountry and how long CPR should continue in the event of cardiac arrest:

» Even in urban settings, CPR—with delayed use of an automated external defibrillator (AED) or delayed access to advanced medical care—has success rates of only 1 to 6 percent.

» CPR should not be initiated in patients who have obvious signs of death, such as pooling of blood, rigor mortis, or decapitation.

» Consider that CPR is exhausting to a rescuer, particularly in extreme conditions found in the backcountry where energy may be required for self-evacuation. Safety of the rescuers should be considered in decisions regarding duration of CPR attempts in the backcountry.

» Current American Heart Association guidelines advise discontinuing CPR in patients who have sustained non-traumatic or blunt traumatic cardiac arrest after a trial of advanced cardiac life support (ACLS) has been given. However, since ACLS is generally unavailable in the wilderness, if a patient has been pulseless for longer than 15 minutes with or without CPR, further attempts at resuscitation should not be made (exceptions are lightning or hypothermia victims).

» CPR in the wilderness has the highest success in patients who have been struck by lightning.

» A hypothermic patient is "not dead until warm and dead."

These considerations should not prevent initiating CPR in situations where a helicopter or ACLS is accessible within 15 to 30 minutes even if a prolonged evacuation may follow resuscitation.

CPR may actually precipitate ventricular fibrillation in a patient with a pulse that is weak or slow enough to be undetectable. Therefore, CPR should not be started unless careful examination (palpating for a pulse for at least one minute) reveals no signs of life, or ventricular fibrillation is strongly suspected because of a sudden event such as collapse of the patient or loss of a previously detected heartbeat.

CPR is not indicated if it places the rescuers in danger, if the patient's core body temperature is less than 50 degrees F, or if the chest is frozen and non-compressible. During a technical extrication, it is better to focus efforts on removing the patient from a dangerous situation, such as extrication from a crevasse fall, before starting CPR in a safer location. Adequate CPR usually cannot be performed during a technical extrication.

Sterile dressings and fluids for cleaning wounds may not be available. Water that is clean enough to drink is adequate for cleaning wounds. Clothing may be used for dressing wounds. Patients with substantial blood loss should be treated for shock and given fluids. As always, continue to reassess the patient on a regular basis.

Tourniquets should be employed only in extreme situations because their use generally commits the limb to amputation. Use a tourniquet when the limb is already amputated or nearly amputated and there is massive arterial bleeding that cannot be stopped by pressure points.

### INTERNAL INJURIES

Much like internal head injuries, internal abdominal injuries cannot be treated in the wilderness and patients must be evacuated immediately. Assessment of the abdomen and back should be thorough. Traumatic abdominal injuries that have increasing pain or signs of bruising are suggestive of internal bleeding and are particularly unstable. A painful, tender, or pulsating abdomen, vital signs suggestive of shock (tachycardia, rapid breathing, falling blood pressure), and symptoms such as bloody urine or nausea and vomiting may be indicative of internal bleeding and should increase suspicion of an internal injury.

## MEDICAL ILLNESS

Most medical illnesses cannot be adequately treated in the wilderness and require evacuation for advanced medical care. Following are those conditions that may be treated in a backcountry setting.

### MYOCARDIAL INFARCTION OR HEART ATTACK

Signs and symptoms of unstable angina, myocardial infarction, or heart attack, include the following:

- Severe chest pain associated with radiating pain to the shoulder or arm
- Sweating
- Difficulty breathing
- Nausea
- Lightheadedness

Although it is beyond the scope of an OEC technician to do so, patients with chest pain should be given 325 milligrams of crushed or chewed aspirin or nitroglycerin (if prescribed). A patient with chest pain that resolves during evacuation should still be taken to advanced medical care because unstable angina may progress to a myocardial infarction and heart failure. Arhythmias may occur as well.

### STROKE OR BRAIN ATTACK

Any patient with signs or symptoms of a stroke should be evacuated immediately. If, during evacuation, the patient's symptoms resolve, rescuers can consider that the stroke event was a transient ischemic attack (TIA). These types of strokes are, by definition, ischemic, meaning they are caused by an inadequate blood supply,

and can be appropriately treated with 325 milligrams of aspirin to help prevent subsequent TIAs or a full stroke while the patient is being taken to advanced medical care.

In a minority of cases, aspirin given to a patient with a hemorrhagic stroke will impair the blood's ability to clot, increasing the bleeding and the potential for a stroke resulting in death. For this reason it is important that patients with strokes do not receive aspirin or any other blood thinner unless it is determined to be ischemic. In general, any patient suspected of having a stroke should not be given blood thinning medications.

### ANAPHYLAXIS

Pre-screening of group participants will help identify people with allergies that may lead to anaphylaxis. These people should have access to injectable epinephrine, and others in the group should be made aware of where it is kept and how to administer it.

As stated earlier, administering any medication beyond oxygen is outside OEC treatment guidelines. In the case of anaphylaxis, epinephrine may be the only means to prolong patient survival. The allergic reaction typically outlasts the effects of epinephrine. Therefore, if limited amounts of epinephrine are available, it should be administered when the patient's airway is in danger of compromise. Antihistamines such as diphenhydramine (Benadryl) do not reverse allergic reactions like epinephrine does, but they can act to slow the reaction. Optimal treatment for anaphylaxis includes epinephrine followed by antihistamine when the patient is able to swallow, and rapid evacuation prior to recurrence of anaphylaxis.

### DIABETES

Hypoglycemia, or low blood sugar, is generally a more life-threatening condition than hyperglycemia, or high blood sugar. Therefore, a diabetic who has an altered mental status should be given sugar and not insulin. Current OEC guidelines state that nothing should be placed within the mouth of an unconscious patient; however, in a remote setting, applying a small amount of glucose paste or similar non-solid, non-liquid product to the oral tissues may prolong survival and significantly reduce brain damage. Diabetics with an altered mental status should not be given insulin.

### SUMMARY

- Caring for patients in the wilderness is complex. As resources are frequently limited, rescuers must be able to improvise in order to provide treatment.
- Rather than learning a singular approach to caring for a given problem, a successful wilderness rescuer is able to adapt to any situation and provide the best treatment possible.

## ABOUT THE NATIONAL SKI PATROL

The National Ski Patrol is a member-driven professional organization of registered ski patrols striving to be recognized as the premier provider of training and education programs for emergency rescuers serving the outdoor recreation community. To meet that goal, and promote the safe enjoyment of snow sport enthusiasts, NSP supports its members through accredited education and training in leadership, outdoor emergency care, safety programs, and transportation services.

## ABOUT THE MOUNTAINEERS

THE MOUNTAINEERS, founded in 1906, is a nonprofit outdoor activity and conservation organization whose mission is "to explore, study, preserve, and enjoy the natural beauty of the outdoors . . . . " Based in Seattle, Washington, it is now one of the largest such organizations in the United States, with seven branches throughout Washington State.

The Mountaineers sponsors both classes and year-round outdoor activities in the Pacific Northwest, which include hiking, mountain climbing, ski-touring, snowshoeing, bicycling, camping, canoeing and kayaking, nature study, sailing, and adventure travel. The Mountaineers' conservation division supports environmental causes through educational activities, sponsoring legislation, and presenting informational programs.

All activities are led by skilled, experienced volunteers, who are dedicated to promoting safe and responsible enjoyment and preservation of the outdoors.

If you would like to participate in these organized outdoor activities or programs, consider a membership in The Mountaineers. For information and an application, write or call The Mountaineers Program Center, 7700 Sand Point Way NE, Seattle, WA 98115-3996; phone (206) 521-6001; visit www.mountaineers.org; or email info @mountaineers.org.

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