Chapter 24
Emergency Action Principles and First Aid

Use the Emergency Action Principles to get an accident situation under control quickly. These simple steps will help you take control of an emergency situation and treat immediate life-threatening problems in a safe, methodical manner. The objectives are to avoid injury to you while you are treating a life-threatening situation, to prevent further injury to the victim, and to get help on the way to the accident site if needed.

24.1 Emergency Action Principles

Survey the scene and determine if it is safe for you to work in.

Do a primary survey of the victim called the ABC's, D & E:

- **A**irway: Is it open? Minimize neck movement as much as possible; apply cervical collar if available.

- **B**reathing: Is the victim breathing? Look, listen, feel. Rescue breathing if necessary.

- **C**irculation: Is there a carotid pulse? Is there severe bleeding? CPR if necessary.

- **D**isability: Is there injury to the nervous and musculoskeletal systems? Stabilize "C"-spine.

- **E**xposure: Remove victim from offending environment. If necessary, place tent over victim.

Radio for medical advice: the medical personnel at each station will determine if a medivac is necessary. All serious medical problems in the field must be reported to the station medical personnel.

When you call the station for medical advice, be prepare to give a brief description of the injury or illness and how and when it happened. The doctor will also want the patient's vital signs and any changes in them. As a reminder the vital signs are as follows:

- **Pulse rate:** In an emergency, the best places to find the pulse are the carotid artery in the neck, or the femoral artery in the groin. In hypothermia cases, you should check for a minimum of one minute. Use the first three fingers to feel the pulse. Never use the thumb, which has a strong pulse of its own that can be mistaken for the patient's pulse.

  If a patient has a severely injured extremity, record the presence or absence of a pulse beyond (distal to) the injury, and after alignment or splinting.

- **Respiration rate:** (Normal respiration rate is 12-20 per minute.) Look, listen, and feel for

weak respirations. A light hand on the chest can detect the rise and fall of breathing, and will keep you "in touch" with the patient.

In cases of High Altitude Pulmonary Edema (HAPE), those who are experienced in listening to lungs may hear "rales" (crackles) when pressing the ear tightly against the chest wall; a stethoscope isn't necessary. They may be detected first by listening at the level of the right nipple, below the armpit. A cardboard toilet paper tube was used with success by a Field Safety Instructor to listen to and detect rales in a HAPE victim. Cheyne-Stokes respirations may occur during sleep; this is characterized by irregular breathing with pauses and gasps between breaths and are a sign that the body is not acclimated to the altitude, but it can also be a "normal" response to higher altitudes (approaching 10,000 feet pressure altitude).

- **Blood Pressure:** (Normal is pressure is about 120/80, however, 90/50 to 140/90 may be normal for some people.) If you do not have a blood pressure cuff and you can detect a radial pulse (the pulse on the thumb side of the wrist, taken on an uninjured arm), the patient must have a systolic pulse (highest point of the blood pressure curve) of at least 90.

- **Temperature:** (Normal body temperature is around 98.6° F (37.0°C).) Body temperature usually is taken by placing the bulb of an oral thermometer under the tongue and leaving it in

place, with the lips closed around it, for three minutes. A reading of 101.5° F or above signifies a fever and a reading below 95° F indicates hypothermia.

Rectal temperatures are preferred for hypothermic or unconscious victims, but are difficult to obtain. Taking a rectal temperature requires a rectal thermometer, which are lower reading thermometers. The bulb of a rectal thermometer is shorter, wider, and rounder, and frequently, the top end of a rectal thermometer is flat.

- **Level of consciousness:** A patient with a normal level of consciousness is alert, oriented, talks coherently to the examiner, and can easily answer questions about identity, location, day, and time of day (although time of day is difficult for any of us working in Antarctica). Report any abnormal findings in mental status, verbal, and motor responses.

Important Note: The doctor may ask you for additional information regarding the victim's condition. Following are five common signs that you may be asked to provide information on:

1) **Skin temperature, moisture, and color:** Examination of the skin furnishes important clues regarding oxygenation, general body stress, and the status of circulation to the skin. However, in dark-skinned people, skin pigment may mask color changes, and examination of the whites of the eyes or the nailbeds may be

more reliable. Red skin can be a sign of high altitude problems or advanced carbon monoxide poisoning. Hypothermia may produce pale or bluish, cold, dry skin. Bluish skin (cyanosis) is a sign of inadequate oxygen in the blood. An illness or injury that stimulates a stress response from the sympathetic nervous system leading to increased heart rate and increased sweating is indicated by pale, clammy, cold skin.

2) **Capillary refill:** Using the thumb and forefinger, squeeze a finger or tip of toe until the nail blanches, then release the pressure. The tissue under the nail should return to their normal pink color within two seconds.

3) **Reaction of the pupils:** The pupils are normally round and equal to each other in diameter. Unequal pupils (one pupil normal while the other is dilated) frequently indicates a serious injury involving the brain on the same side as the dilated pupil. However, it is normal for some individuals, so if you see it in a victim ask them if this is normal. The pupils are the "windows to the brain." Patients who are in cardiac arrest generally have dilated pupils that do not constrict in response to bright light. The pupillary response to light is also lost after death.

4) **Reaction to pain:** Pinching the victim's skin and asking "can you feel this?'' should invoke a response of some sort. Inability to feel pain usually means damage to the nerve pathways.

5) **Ability to move:** To test for impaired movement, ask the patient to move his or her fingers and toes and to squeeze your hands. A conscious patient who is unable to comply is said to be "paralyzed." The paralysis can involve a single extremity, one side of the body, or both sides of the body. Record exactly what the patient can or cannot do, and relay that information over the radio. Paralysis can be caused by severe injury without nerve damage if motion is so painful that the patient refuses to try to move.

Do a secondary survey of the victim: Interview the victim and /or companions, and conduct a thorough head-to-toe exam. Record the victim's vital signs at regular intervals, with the date and time of each entry. If the patient is about to be transported, affix a piece of tape on the patient's forehead with the most recent vital signs, date, and time recorded with an indelible marker.

24.2 Frostbite

Frostbite is the freezing of body tissue. Frostnip of your nose, cheeks and ears can be prevented by using the buddy system. Watch your partners and tell them if you see blanched, frozen skin on their faces. When red cheeks and noses become white, cover up! Just by turning one's face out of the wind and covering up the affected skin, you can often cure the problem. If your extremities are cold enough to freeze, you might be getting hypothermic, which is life threatening. Polypropylene glove liners work wonders for protecting fingers from cold metal instruments, cameras, etc.

The hands, feet, ears, cheeks, and nose are all located far from the heart at the periphery of the body and are subject to rapid heat loss because of their large surface-area-to-volume ratio and their exposed positions. Other factors that contribute to frostbite include inadequate insulation, wet clothing, fatigue, poor nutrition, alcohol, tobacco, restricted peripheral circulation (because of tight clothing or equipment), and contact with metal or hydrocarbon liquids such as gasoline.

Frostbite often develops during periods of severe environmental stress when facilities for proper emergency care are nonexistent, and the party's main concern is to escape alive.

Superficial Frostbite: Superficial frostbite, often called frostnip, feels like a mild tingling or pain followed by numbness. Inspection reveals a gray or yellowish patch of skin, usually on the nose, ear, cheek, finger, or toe. The tissues beneath the area remain soft and pliable. This type of frostbite is common with most people that have worked in Antarctica.

Treatment of Superficial Frostbite: Apply direct body heat, e.g., by placing a warm hand on a frozen cheek, nose, earlobe, or holding a frozen finger in an armpit, feet on a warm stomach. The first-aider should consider why frostbite occurred; the patient should add clothing and seek shelter.

Deep Frostbite: Deep frostbite is a full- or partial-thickness freezing of a body part that mainly affects the hands and feet. It should be suspected if a painfully cold part suddenly stops hurting when the part obvi-

ously is not getting warmer. The affected part is cold, solid and wooden with pale, waxy skin; it resembles a piece of chicken just removed from the freezer.

Experience has shown that the amount of permanent tissue damage depends on both how low the temperature is and how long the body part is frozen; rapid rewarming causes less damage that slow rewarming.

Treatment of Deep Frostbite: The proper emergency care for deep frostbite is rapid rewarming in a water bath with the water temperature carefully controlled between 102°and 108°F (39° to 42°C). Cooler water rewarms too slowly; warmer water may burn the tissues. Rewarming should be done only in a shelter where the patient's entire body can be kept warm. The rescuer will need a high-registering thermometer and a vessel large enough so that the extremity can be immersed without touching the sides of the vessel. A 20-quart pot is the minimum size needed for rewarming a foot. As a rule, rewarming continues for 20 to 30 minutes or until the frozen areas turn a deep red or bluish color and the color change has progressed distally as far as it will go. As the water bath cools, remove the extremity, add hot water, stir, and retest the water temperature before reimmersing the extremity. Rewarming usually causes severe pain.

While the frozen part is being rewarmed, maintain the patient's morale with hot drinks and apply heat to non-frozen body parts to open up circulation to the frozen area. Be aware that the victim will experience some discomfort during the rewarming process, pain medications may be warranted. Protect a thawed limb against

refreezing, infection, and trauma by applying thick layers of sterile dressings held in place by a loosely applied, self-adhering roller bandage. Leave blisters unopened, separate digits with soft cotton or wool pads, and elevate the part to reduce swelling.

Exercise judgment in deciding whether to rewarm a frozen extremity in the field. Do not attempt rewarming if there is any chance that the extremity may refreeze. Field rewarming is indicated if there is a good chance that the part will thaw spontaneously during evacuation. However, if the patient cannot be kept warm or cannot be carried out, it is permissible to let the patient walk or ski out on a frozen foot. Care must be taken to keep the foot frozen until it can be rapidly rewarmed under suitable conditions. This has been shown to cause less permanent damage than allowing the part to slowly thaw during transport.

Patients frequently become aware of a frozen part because of the pain that accompanies thawing. Depending on the size and isolation of the party, there may be no alternative to self-evacuation on the thawed foot. If that is the case, refreezing should be prevented at all costs because it often leads to gangrene.

24.3 Hypothermia

Hypothermia is the lowering of the body core temperature and can occur from a number of different types of situations. On the Peninsula, personnel must be aware that hypothermia can result from exposure to cold rain and high wind, and from falling into cold water. In other field locations where rain is not an issue, hypoth-

ermia is still a threat because it is simply a lowering of the core temperature. When it drops and the downward trend is not stopped, the patient will eventually die. Prevention is the key. Proper layering of clothing, adequate food, and sufficient hydration are key elements in avoiding hypothermia.

It is critical to recognize the signs and symptoms of mild hypothermia, so as to stop its progression to profound (severe) hypothermia. If the body-core temperature drops, the body will sacrifice the arms and legs to keep warm blood around the vital organs: brain, heart, lungs, kidneys, and liver. That is called shunting. The warm blood is decreased to the limbs. It is difficult to recognize in oneself. If you are having a hard time working your hands (such as difficulty tying your boot laces), your body core is cooling down. Most hypothermic victims deny that they are having trouble. You must take action.

Signs and Symptoms of Hypothermia

- Difficulty working hands
- Shivering
- Stumbling
- Bumbling
- Withdrawn and grumpy attitude
- Denial

Treatment of Hypothermia: The first priority is to prevent further heat loss by getting the patient out of the wind (and snow, and water) and into a tent or other shelter. The patient should be given dry clothing and put into a sleeping bag, if available. If a sleeping bag is unavailable, put spare clothing under and over the

patient and cover the patient's head. Avoid unnecessary handling and do not allow the patient to sit, stand, or walk until he or she is rewarmed. It may be better to cut off wet clothing than to undress the patient; if no dry clothing is available, wrap the patient in a tarp, space blanket, plastic sheeting, or similar material to reduce evaporative cooling. It is more effective to "package" the victim in a "hypothermia wrap" than to lay with the victim in two bags zipped together.

> **Hypothermia wrap:** Remove damp clothing from victim. Dress victim in dry synthetic underwear, balaclava, neck gaiter. Wrap victim in a vapor barrier such as a space blanket, plastic tarp, etc. Place victim in sleeping bag. The more bags the better. Place hot water bottles (wrapped in a sock to avoid burns) on victim's trunk, armpits, groin area. Insulate the head and neck with extra sweaters, jackets, etc. Place another vapor barrier around the outside of the sleeping bags.

Further emergency care depends on the patient's measured or estimated core temperature. If a thermometer is unavailable, the patient can be considered to have a core temperature above 90° F (32° C) if he or she is still shivering and capable of appropriate actions such as zipping an open parka and picking up a dropped mitten. The core temperature is very likely below 90° F if the patient is no longer shivering and especially if he or she has become stuporous or comatose.

Mild Hypothermia: A hypothermic patient whose rectal temperature is 90°F (32°C) or above can be rewarmed by any means available; these means will be limited under field conditions.

Profound Hypothermia: The mortality rate outside a hospital is high for patients who have a rectal temperature below 90° F (32°C). In-hospital survival is better because medical personnel can discover, monitor and rapidly treat metabolic and electrolyte problems, and rewarm the patient under controlled conditions. This is bad news for the remote Antarctic victim, where hospital rewarming is potentially days (or weeks) away.

Patients with profound hypothermia may appear to be dead because their pulses and respirations are so difficult to detect. Spend a minute or longer attempting to detect both vital signs before concluding that they are absent. The motto "No one is dead until warm and dead" emphasizes that all patients with hypothermia deserve an attempt at rewarming.

Summary care for unconscious victim immersion or Submersion Hypothermia:

- If someone falls overboard, immediately call the station for help as you maneuver the boat for the pickup.

- Survey the scene—don't become a victim yourself.

- Horizontally lift victim from the water gently if it can be done without delaying the rescue.

- ABC's:

  Airway: Is it open? head-tilt/chin lift; use jaw thrust if cervical spine injury is indicated.

Breathing? Is the victim breathing? Look, listen, feel. Rescue breathing if necessary.

Circulation? Is there a carotid pulse? Is there severe bleeding? If no circulation then:

- Start CPR if the victim has been in water for less than one hour or the time is unknown, assume the victim is alive.

- Package the victim in a HYPOTHERMIA WRAP as described above for transport.

- Do not give up!

24.4 Carbon Monoxide Poisoning

Carbon monoxide poisoning is fairly common. It can be a significant hazard in the Antarctic environment, particularly when stoves are used in poorly ventilated shelters such as tents, snow caves, and igloos. Many polar explorers have been killed or narrowly escaped death from carbon monoxide poisoning caused by operating stoves in tightly closed areas.

Carbon monoxide is a colorless, odorless gas that is produced by incomplete combustion of carbon-containing substances. Dangerously high levels of carbon monoxide can form whenever fuel is burned in a poorly ventilated space. When inhaled, carbon monoxide combines with the hemoglobin in red blood cells and renders the cells incapable of carrying oxygen. Even a very low concentration of carbon monoxide (0.06%) is

enough to block one half of all hemoglobin available to transport oxygen. Carbon monoxide also combines with cellular enzymes and causes tissue damage, particularly in the heart and brain.

The signs and symptoms depend on the amount of carbon monoxide the patient has inhaled. In mild cases, the patient may complain of dizziness, headache, and confusion. Fatigue, numbness, chest pains, heart palpitations, and visual disturbances may also be present. Severe cases may manifest as a deep coma. Many experts feel that some effects attributed to acute mountain sickness may, in fact, be caused by carbon monoxide. Carbon monoxide poisoning is also frequently misdiagnosed as migraine, stroke, alcohol intoxication, heart disease, food poisoning, and psychiatric illness. Recognizing this insidious condition may be difficult when all members of the party are affected.

Carbon monoxide is eliminated from the body very slowly under normal conditions, and it continues to cause tissue damage as long as it is present. Victims of carbon monoxide poisoning may suffer neurological complications a few days to three weeks after exposure, and as late as two years after apparent complete recovery. These complications include memory impairment and personality change, and they may be permanent. Carbon monoxide poisoning should be taken very seriously.

Treatment of Carbon Monoxide Poisoning: Victims should be immediately removed from the contaminated area. To hasten the elimination of carbon monoxide, all victims should be provided with 100% oxygen, no

matter how slight or apparently inconsequential their symptoms. The oxygen should be administered via a securely sealing mask and a demand valve. (Other methods of administration, such as nasal cannula, do not deliver 100% oxygen.) Severely affected patients may require rescue breathing (with oxygen) and should be evacuated to an appropriate medical facility.

McMurdo: Patients in the McMurdo area should be taken immediately to the McMurdo Hyperbaric Chamber (at the McMurdo Medical Facility) for evaluation and treatment. Hyperbaric oxygen treatment greatly increases the rate of carbon monoxide elimination and speeds recovery. Further, the late term neurological complications described above have not been reported in people treated with hyperbaric oxygen.

Peninsula: Patients in the Peninsula area (or other areas without hyperbaric chamber availability) should be administered oxygen for a minimum of four hours, or, if oxygen supplies are limited, for as long as possible. Eight hours of 100% oxygen will eliminate almost all carbon monoxide from the body.

24.5 Quick Patient Packaging and Emergency Moves

Because of the extreme cold of the Antarctic environment, injured patients must be assessed and packaged very quickly. A fractured cervical spine, for example, will predispose a victim to a quick case of hypothermia which will complicate what is already a possible life-threatening injury.

If there is no time to immobilize injuries before moving a patient, the spine and other injured areas should be protected as much as possible by using a multi-rescuer lift and transfer, or by pulling the patient in the direction of the long axis of the body, so that the back, neck, or an injured extremity undergo minimal twisting. See figure 24-1.

Note: Participants in Field Safety Training scenario drills are always surprised how difficult it is to transport an "injured actor" a mere 150 feet on solid snow to a shelter without aggravating a spine injury.

Put Shelter Over the Patient: You may choose to provide care and shelter for the patient right at the scene of the accident. A Scott tent can be placed over the patient, or the floor of a mountain tent can be sliced open with a knife, and the tent positioned over the patient. This provides very quick relief from the wind. With the help of others, the patient can be lifted or rolled onto insulation, and packaged with a "hypothermia wrap" (see Section 24.3). Remember, the main danger of moving, lifting, or rolling a patient is aggravating a spine injury.

Improvised backboards and stretchers might include sleds, skis, backpack frames, blankets with poles, climbing rope, pieces of wood or plywood.

Improvised splints might include ice axes, bamboo poles, skis, ski poles, pieces of wood, stiff foam mats or Crazy Creek chairs, uninjured portions of the patient's own body (e.g. leg tied to leg).

Figure 24-1: Immobilized patient.

C-Collar: Suspected spinal cord injuries require manually stabilizing the patient's head and neck with slight traction, and then applying a rigid extrication collar (c-collar). If a c-collar is not available, improvise with several layers of ensolite or blue foam, cut to fit and strapped in place around the patient's neck. A rolled-up blanket wrapped around the head in a "U" shape and secured with tape to a backboard will also work as a make-shift collar that provides support and insulation.

Logrolling a Patient: Logrolling a patient is a technique used to roll a face-down patient into the supine (face-up) position; and it is used to roll a patient onto his/her side so that a backboard, insulation, or hypothermia wrap can be placed underneath the patient. It is performed in a way that avoids producing motion at the site of injury.

- One person must manually stabilize the head/neck with slight traction, while the other rescuers position themselves along side the victim. Apply c-collar.

- Tie the patient's legs together with a cravat (or webbing, cord, etc.). The person at the head should continue to hold slight traction and with the thumbs on the back of the head behind the patient's ears, the index fingers on the jaw angles, and the remaining fingers along the jaw and cheeks. Three other rescuers should kneel in a row on the side to which the patient will be rolled.

- The patient's arms are placed along the side of and next to the patient's body with the palms against the elbows locked to "splint" the spine.

- The second rescuer, who is kneeling beside the patient's shoulders, holds the patient's arms tightly against the body by placing one hand on the patient's opposite shoulder and the other hand on the opposite forearm. The third rescuer kneels besides the patient's buttocks, with one hand on the iliac crest and the other hand on the

mid thigh. The fourth rescuer kneels beside the patient's knees, with one hand on the opposite knee and the other hand on the opposite leg just below the calf.

- The first rescuer (at the head) is in charge and gives the signal for the other three rescuers to

Figure 24-2: Logrolling a patient.

roll the patient slowly towards themselves, avoiding any twisting or bending of the neck. The third rescuer (at the buttocks) can then reach across the patient and pull the backboard, pad, hypothermia wrap, etc. up tight and under the patient.

- Upon the first rescuer's command (at the head), the patient is slowly lowered ("rolled") back down on the backboard, pad, etc. (See figures 24-2 and 24-3.)

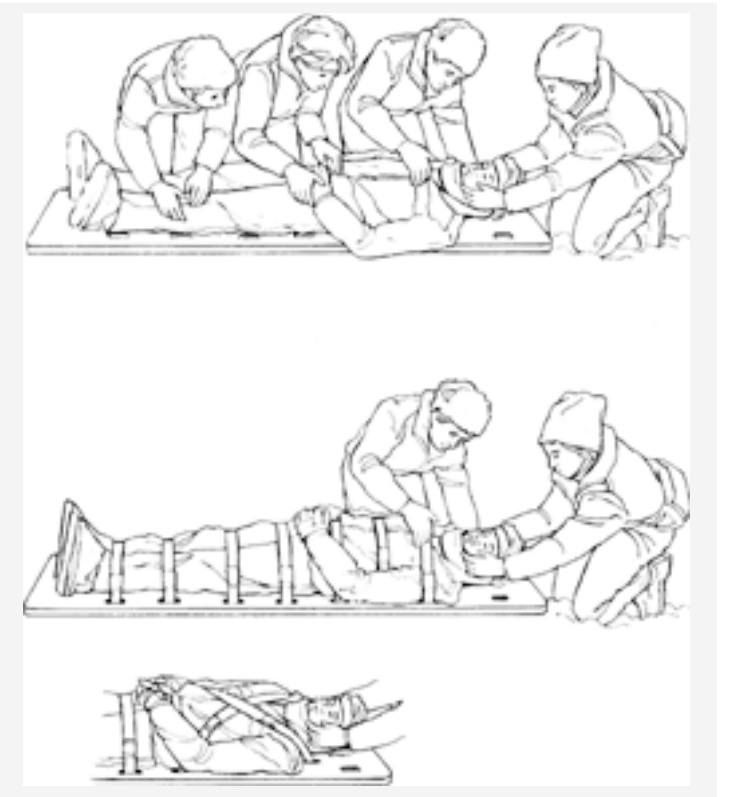

Figure 24-3: Immobilizing a patient.

One Rescuer Moves for Possible Spinal Injury: Roll the patient into the face up position. This is difficult for a single rescuer because the patient must be rolled without twisting the neck or back. The patient can be pulled by the feet and dragged feet first, or pulled by the clothing by gabbing the patient under the armpits or by grabbing handfuls of clothing behind the shoulder blades and cradling the patient's head and neck in your forearms dragging the patient head first.

It is preferable to pull the patient on a tarp or space blanket. The tarp can be place under the patient by first pleating or tightly rolling it lengthwise, leaving one-third flat. Place the rolled side of the tarp alongside the patient and push it under the patient's body; pull the tarp from the opposite side so that it unrolls under the patient.