Wilderness EMS Protocols

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comments and suggestions to:
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An online version at http://www.wemsi.org.

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I. Authority

Wilderness EMS is different from "street" EMS, as outlined in publications of national medical organizations such as the Wilderness Medical Society and National Association of EMS Physicians (references available from WEMSI on request). WEMSI recognizes the limitations of "street" EMS protocols, standing orders, and on-line medical command, and has established protocols, standing orders, and on-line medical command specific to cave and wilderness search and rescue.

The Appalachian Search and Rescue Conference (ASRC; www.asrc.net) Medical Director for Pennsylvania, appointed by the Board of Directors of the ASRC (Dr. Conover), has by policy assigned oversight for all medical care rendered by the ASRC in Pennsylvania to WEMSI. The Medical Director for Eastern Region, National Cave Rescue Commission (ER-NCRC; www.caves.org/ncrc/) (Dr. Sam Chewning), has by policy assigned oversight for all medical care rendered in multiple states to WEMSI. Both organizations are recognized as ''special response'' EMS agencies in Pennsylvania's EMSI EMS Region (SR003 and SR004) as is WEMSI (SR005); ER-NCRC personnel, and WEMSI as its medical control source, provide medical care outside Pennsylvania on a mutual aid request basis. A detailed description of WEMSI accreditation, medical control, and communications is found in the WEMSI Operations Policy Manual, a separate document, available on the WEMSI web site (www.wemsi.org).

These protocols shall have the same force as a physician's order. The only acceptable reasons to deviate from these protocols, by physician's order, are:

1. an accredited WEMSI Wilderness Command Physician has established Medical Communications, as defined in the WEMSI Operations Policy Manual, with those at the patient's side, or
2. a licensed physician is at the patient's side and has accepted full responsibility for the patient's care.

II. Scope and Applicability

These protocols shall be followed whenever:

1. a patient of any state or country being cared for by ER-NCRC personnel, *OR* a patient in Pennsylvania is being cared for by Appalachian Search and Rescue Conference personnel, *OR* a patient is being cared for by personnel of another wilderness EMS agency for which WEMSI has agreed to provide medical direction; *AND*
2. the patient is in a cave, or backcountry area, or disaster area, or has not yet reached a ground or air ambulance.

Based on agreements between WEMSI and SAR organizations for which WEMSI provides medical control and oversight, these protocols apply to all SAR team personnel providing medical care, whether or not the SAR team personnel are trained or accredited by WEMSI.

If a patient is being cared for by both WEMSI personnel and local EMS personnel,

these protocols take precedence over local EMS protocols, unless those local EMS protocols have specific provisions for care of wilderness/backcountry patients.

Once the patient reaches a ground or air ambulance, however, the responsibility of WEMSI personnel comes to an end, and the local EMS agency protocols and standing orders take over. The only exception is due to WEMSI personnel's specialized training in managing certain problem such as hypothermia. If the patient has a problem about which WEMSI personnel have special training, then the highest-trained WEMSI medical person will ride to the hospital with the patient. (To do otherwise would be abandonment: allowing someone with less training to take over patient care.) If, during transport, WEMSI personnel find a significant conflict between their protocols or standing orders and those of the transporting EMS agency, they should attempt to contact their own Wilderness Command Physician and ask the Wilderness Command Physician to speak to the local command physician. If they cannot reach a Wilderness Command Physician, they should contact the local command physician directly themselves, explain that the specific protocols and standing orders related to wilderness patients that conflict with local ones, and request a decision from the local command physician.

These protocols apply to patients which WEMSI personnel are rescuing, and to SAR team members who become injured or ill in the backcountry or underground.

Unless there are specific notations about different skill levels, protocols apply to personnel of all skill levels (First Aid/First Responder, Wilderness EMT, Wilderness Paramedic, etc.) The generic term "medic" used herein refers to WEMSI medical personnel of any level of training. "Wilderness Medic" refers to those accredited by WEMSI to operate under WEMSI Standing Orders (see below). Specific training levels noted in these protocols include "Wilderness EMT" and "WEMSI Wilderness EMT." ‘‘Wilderness EMT" includes all "standard" WEMT classes that generally follow the Wilderness Medical Society "WPHEC" (Wilderness PreHospital Emergency Care) Curriculum: WEMSI, WMA, NASAR, SOLO, WMI, and WPT certification. ‘‘WEMSI Wilderness EMT’’ refers specifically to the WEMSI WEMT certification, which goes beyond these to include a rigorous amount of "advanced" techniques and medications.

III. Protocols vs. Standing Orders

The terms "protocol" and "standing orders" are not well-defined in EMS usage, so we are establishing these definitions for the purposes of this document.

A *protocol* is a general way to deal with a specific problem. It generally does not require a physician's order (though these specific protocols should be taken as orders of the WEMSI Medical Director). These protocols include common wilderness search and rescue problems. An example of a protocol is: "always add heat and try your best to rewarm hypothermic patients, unless victims of cold-water submersion (near-drowning)."

A *standing order* is a specific physician's order to be carried out when not in direct contact with a physician. (E.g., "If significant soft tissue infection, fever over 102°F with abdominal pain, suspected meningitis, urinary tract infection, pneumonia, otitis media or sinus infection; and if transport time to a hospital is more than four hours; and if patient has no history of allergy to ceftriaxone (Rocephin®) or to other cephalosporins such as Keflex® or Ceclor®, or history of anaphylactic allergy to penicillin: then give one (1) gram of ceftriaxone. Give IV push if an IV is available, else give by deep IM injection.")

IV. General Protocols

These protocols are written in text form. We do not expect rescue personnel to carry them in the field, but to read, understand and remember the general principles. An abbreviated pocket reference is available, containing specifics that may be difficult to remember.

A. Safety and Survival

Safety of rescuers is paramount; no specifics will be covered here, as safety is a major part of cave and wilderness rescue training. Team leaders should depend on the team medic to provide

advice about the medical condition of team members.

B. Previous Training; Judgment

Personnel providing medical care should follow their first aid or emergency medical training except in those specific situations covered in these protocols. In situations not covered by these protocols or by previous training, personnel must use their best judgment.

C. Medical Command/Control

Personnel caring for a patient or team member with any significant injury or illness should always attempt to contact a Wilderness Command Physician as provided for in the WEMSI Operations Policy Manual. The easiest way is to call the U.S. tollfree number 1-888-866-3729 or the non-tollfree number 1-412-232-5678.

D. Choice of Medic; Rotation of Medics; Reports

Care of any patient should be coordinated by a single person: the *medic*. The term medic is a generic one and does not say anything about the person's level of medical training: the medic could be a physician, nurse, paramedic, EMT-Basic, First Responder, or simply a first aider. All communication with the patient should be by the medic.

In general, the person with the best medical qualifications should be chosen as the medic. However, there may be occasions where the person with the best medical training needs to perform other vital functions; in such a case, the best alternate should serve as medic.

It is appropriate for a medic to hand over care to a more experienced medical person when one becomes available. It is also appropriate for a medic to be replaced by another person so as to be able to rest. It even may be appropriate for a medic to be replaced by a less-capable medic, to avoid exhaustion or hypothermia of the original medic.[*]

When a medic turns over care of a patient during a rescue, the medic *must* make and turn over a written report to the new medic, unless taking the time for a written report would place the medic or patient at risk, with:

1. results of the initial examination of the patient, including all injury or illness detected,
2. any care rendered so far, vital signs, and
3. medical plans for the remainder of the rescue.

Obvious exceptions would be if the original medic were exhausted, hypothermic, or seriously injured.

E. Primary and Secondary Surveys; Vital Signs

1. Primary Survey, Bleeding Control

Applying a tourniquet on the street is deciding to sacrifice a limb to save a life. EMTs rarely, if ever, need to use a tourniquet, because direct pressure and elevation almost always stop bleeding.

Continued slow bleeding is not a major problem for most EMTs. The patient will be in the Emergency Department before the continued blood loss will be a problem. With long evacuation and transport times, though, even slow external bleeding can cause shock. Usually, if you can slow the bleeding down, the body's own clotting mechanisms will stop the bleeding. However, these clotting mechanisms may not work properly under certain conditions, e.g., hypothermia, extensive crush injury, or snakebite.

The key to control bleeding to use firm *localized pressure* over the bleeding vessels. Your gloved finger, covered with a single gauze pad to make it less slippery, is ideal. You should apply pressure for a full ten minutes, then release pressure and see if it bleeds again. (Use your watch to time yourself) If it starts bleeding again, apply pressure, this time for fifteen minutes. If you release pressure or slip off the blood vessel and it starts again, start holding again for another full count by the clock. (When the bleeding starts again, the clot that had been building is pushed

[*] The doctrine of abandonment would seem to require a medic only to allow a replacement medic of similar or higher qualifications, but a court would certainly recognize personal danger of hypothermia and exhaustion as reasons for leaving a patient's side.

off by the bleeding.) Once the bleeding is controlled, you can apply a pressure dressing with a wad of small gauze pads under it to replace your finger's pressure to prevent it from bleeding again.

The standard rule on the street is not to remove blood soaked dressings, but to place new dressings on top. This is not appropriate for the wilderness. In the wilderness, you should remove blood-soaked dressings, identify the bleeding vessels, and apply pressure to them as described above.

On occasion, you may find it difficult to adequately stop bleeding, because you can't precisely identify the bleeding vessels. In such a situation, you may be able to use a temporary tourniquet as a tool to identify the bleeding sites. Surgeons and emergency physicians routinely use tourniquets for up to thirty minutes to allow "bloodless field" surgical repairs. Having details not obscured by bleeding makes the surgical repair much easier. Similarly, you can use a tourniquet to locate the bleeding vessels; you then apply direct pressure, and release the tourniquet. If you put a tourniquet on someone's limb, the limb won't become severely painful for about half an hour, and you won't start having irreversible damage to the limb for another fifteen minutes. However, you shouldn't need a tourniquet for more than a few minutes. (You should only apply a tourniquet by a specific doctor's order or standing orders from your medical director.) Whenever you apply a tourniquet, it must be *wide*, to prevent damage to soft tissues, and *tight*, to prevent any leakage. A blood pressure cuff makes an ideal tourniquet, provided you can ensure that it doesn't deflate. A clamp on the BP cuff tubes will work, provided you watch the cuff to make sure it doesn't leak.

Various materials can be placed into or onto wounds to help staunch bleeding. Thrombin powder works well. However, only one particular brand and type is stable for more than thirty days at room temperature. (Thrombin 5,000, 10,000, and 20,000 units (topical powder), Johnson & Johnson, is stable for three years at room temperature.) Other common materials include GelFoam® and oxidized regenerated cellulose (Surgicel®), both of which are stable at room temperature. These are light and may be carried and used, but are so seldom useful that their inclusion in a personal wilderness medical kit is questionable.

2. Extent of Secondary Survey

For minor injury or illness of a search and rescue team member, the medic may need only to examine the affected part. For instance, a complete primary and secondary survey is not needed for someone with a splinter in the little finger. For a rescue situation, however, the medic should perform as complete a survey as possible.

If a previous provider has performed a survey and started treating the patient (e.g. splinting injuries), or the evacuation is already in progress, the medic has two choices: to accept the reported survey and start (or continue) transporting the patient, or to take off bandages and splints, undress the patient, and re-examine the patient.

In almost all rescue situations the medic should take off previously applied splints and examine the patient completely prior to evacuation.

If the patient is stable, and there are no serious injuries, and the environment isn't severe, then a few minutes for an exam won't hurt.

If the patient is significantly injured, though -- even a leg fracture -- a few minutes for an exam by a trained medic may be a worthwhile investment even if the environment is bad.

We have documented no cases where stopping a rescue for a medic's exam have slowed a rescue and caused any real problems for the patient or rescuers. But we *do* know of several cases where rescuers' reluctance to "let someone slow things down just to play medic" have resulted in additional and preventable medical complications for the patient, such as a closed fracture turning into an open one without the medic knowing about it and without the medic giving the antibiotics

The only situations where an arriving medic should *not* interrupt the rescue to perform an exam are:

1. if the environment is so dangerous that the patient must be moved immediately for safety of life or limb, or

2. if the medic trusts the previous medic, finds the reported survey to be as complete as needed, and it is consistent with the patient's observed condition, or
3. if a *realistic* estimate of the evacuation and transportation time indicates the patient will soon be in a medical facility (on the order of an hour) and has no gross evidence of life- or limb-threatening injury.

3. Vital Signs

The interval for taking vital signs, and the vital signs to take, are medical decisions to be made by the medic, in consultation with the Wilderness Command Physician if desired by the medic. Factors that enter into the decision include any danger to the patient from taking vital signs (e.g., exposure to cold), delay in evacuation from taking vital signs, and the stability of the patient. Frequent vital signs are not needed for stable patients; a set of vital signs every few hours might suffice. For a critically ill patient, vital signs every few minutes might be appropriate.

Medics should take and report a temperature on every patient. Even if no thermometer is available, feel the patient's skin and make an assessment of whether the patient's core temperature is normal, cold, or hot. The ideal way to measure temperature in the field is with a specific brand of ear thermometer (Exergen Ototemp® 3000SD; available from Exergen Corporation; One Bridge Street; Newton, MA 02158; 1-800-422-3006; (617) 527-6660.) Other eardrum thermometers are not acceptable; cold or warmth of the external ear canal may lead to false readings. We recommend this thermometer for team medical kits. An acceptable (and less-expensive) alternative is a continuous-reading Radio Shack indoor-outdoor thermometer, available for under US$20; this can be used for continuous monitoring of axillary or rectal temperature. Becton-Dickson makes a very inexpensive electronic fever thermometer that is even lighter and less expensive than the continuous-reading Radio Shack model; it gives a "low" reading for any temperature below 90 degrees F, so it can distinguish deep hypothermia, but not its depth. It is a reasonable alternative for personal first aid kits. The exact contents of the standard WEMSI Personal Wilderness Medical Kit carried by WEMSI-accredited Wilderness Medics is available in a separate publication from WEMSI, available at the WEMSI web site at www.wemsi.org.

If in a cold environment, it is possible to use an oral or axillary temperature to rule out hypothermia: an oral or axillary temperature of about 98 degrees F (or about 36 degrees C) is sufficient to rule out hypothermia. If a patient has an oral or axillary temperature less than this, or if the oral or axillary temperature drops below this during evacuation, obtaining an Ototemp® 3000SD eardrum temperature, or a rectal temperature, is vitally important. In such a situation the medic should overcome any revulsion and be firm very in insisting the patient cooperate. A Radio Shack® or other rectal temperature probe may be placed by any rescuer and requires no special training; place the probe gently a gloved and lubricated finger's length into the rectum; place it up against the wall of the rectum, not in the middle of a piece of stool.

If treating a patient for possible heat illness, oral or axillary temperatures are not acceptable. An Ototemp® 3000SD ear temperature is ideal; a rectal temperature is an acceptable alternate.

4. Orthostatic Vital Signs

To check orthostatic signs, check pulse (and blood pressure if BP cuff available) lying, sitting with legs dangling, and standing. Wait a minute after sitting or standing before rechecking blood pressure and pulse. A sustained drop of more than 10 in systolic blood pressure or a sustained rise of more than 20 in pulse with sitting or standing is a positive test for orthostasis and indicates dehydration or mild shock.

Research has shown that a fair number of people are positive on this test without being dehydrated, and some who are dehydrated will not show "orthostatic" changes, but the test is still of some value. If the patient tries to sit or stand and feels like fainting (regardless of orthostatic changes in vital signs), that's also an adequate indication of orthostasis.

F. Reporting to Medical Command/Base

The medic should make reports to a medical command physician, if medical communication is established, or at least to the operation base. The content and timing must be adapted to the situation, but the following outline is ideal. This applies to written notes (often used in the initial phases of cave rescue) and radio/field phone communications:

ID: Team Identifier and Medic name and level of training
Chief Complaint
History:

- History of Present Illness
- Past Medical History
- Medications
- Allergies

Physical Exam (primary and secondary survey)
Field Diagnoses (or problem list) and Extended Status Code (see below)
Scene:

- Weather
- Terrain
- Resources
- Prior Treatment

Evacuation Time Estimate
Evacuation Priority:

- Hasty (Very Urgent) or
- Urgent or
- Routine or
- Delayed (bivouac)

Treatment Now
Plans for Possible Problems During Evacuation

G. Extended Status Codes

Status Codes are in fairly wide use in wilderness search and rescue, and almost universally understood in the Mid-Appalachian region:
Status I: alive and well, able to evacuate self.
Status II: ill or injured, requiring evacuation and/or medical treatment.
Status III: dead.

Status II may be subdivided for medical reporting. This is a new extension of the standard status codes, and has yet to become widely used. But since these brief codes summarize medical information in a way useful to Incident Staff, it still is worthwhile to give them a try. These codes were chosen to reflect the important differences in patients' clinical status. A table of these codes should be carried by every medically-trained ER-NCRC/ASRC person, and should be posted at all Base Camp communications or Operations Centers, and used for reporting.

Extended Status Codes are as follows. Note the A, B, C, D, F "grades" correspond with the standard U.S. secondary school grading system for ease of remembering them.

Extended Status Codes:
IIA: ill or injured but able to walk/climb out with assistance
IIB: minor to moderate injury or illness; requires evacuation but at a measured pace because patient appears stable for a long evacuation.
IIC: serious injury or illness; stable but requires urgent evacuation.
IID: serious injury or illness; unstable and requires hasty evacuation (e.g., start improvised evacuation even if litter not yet available)
IIF: serious injury or illness, death seems likely before evacuation completed

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Note that actual evacuation plans include not only the patient's condition, but also other factors such as the time of day, weather, terrain, and available resources.

H. Documentation

When available, rescuers of all levels will be expected to use the standard WEMSI patient record forms.

There are four critical areas of medical documentation, listed with the most important first:

1. Decision-making

E.g., Why did you start an improvised evacuation? Why did you move the patient without even trying to clear the cervical spine? Why did you request a higher level of medical personnel before moving the patient?

2. Field Diagnoses

List specific field diagnoses. (All will understand that these are tentative diagnoses made under field conditions.)

3. Exam

Give details of your examination of the patient: What was your overall assessment of the nature and severity of the injuries?

4. Vital Signs and Repeat Examinations

Of these two, repeat examinations and repeat overall assessments are more important.

I. Initial Care of Those Lost or Stranded

Patients who may have been without food or water for a period of days should be given fluids and food unless there are reasons not to (see below). *However*, there are dangers in giving fluids or food to a starving or dehydrated patient:

1. Some patients who have been without food for a long time, or have been sweating excessively from the heat, may have a very low level of salt in their blood; giving water may drive the level down even more, causing confusion, seizures, or coma. Instead of water, give electrolyte drinks such as Gatorade™. Even if the patient has a normal or high salt level in the blood, electrolyte drinks are still good. *Don't give water* unless there will be a long delay until an electrolyte drink is available. An alternative is to add a small amount of salt (one fast-food salt packet, or about a half-teaspoon of salt) to a liter of water or flavored drink.
2. Those who have been without food or water for a long time may become nauseated or vomit if give a large amount to drink or eat. Start with small sips of electrolyte drink, then small bites of food.
3. If the patient has been without food for a very long time (several weeks), food might cause shock and death. This may be prevented by giving the vitamin thiamine, which is contained in almost all multivitamins. If the patient has been starving for several weeks, don't give food unless you also give a thiamine or multivitamin pill.
4. Patients may be disoriented and even perhaps slightly agitated when found. This is usually situational (related to being lost or stranded, not to underlying physical or mental disease.) Even if sedative medication is available, it is best to simply wait about an hour for the patient to recover spontaneously or due to interaction with rescuers. Use medication during this first hour only if the patient is a risk to self or others.

J. Oral Fluids and Food

In general, all patients who are more than a few hours from the hospital should be given food and fluids. The following are reasons not to give food or fluids:

1. Patient is so *lethargic or confused* that the patient may choke if trying to eat or drink. If unsure, you may give the patient sips of water or electrolyte drink and see if the patient chokes. Choking on a small amount of water or electrolyte drink should cause no significant medical problems for a patient.
2. Patient has an ileus: stomach and intestines not working properly; patient nauseated, not farting, no bowel sounds at all. This often comes after trauma (including burns). Assume that anyone with an ''acute abdomen'' has an ileus (see section V.Z.1, page 23).

   If unsure, give the patient sips of water or electrolyte drink and see if the patient vomits.

   However, some patients with a simple "stomach flu" may be able to keep down some oral fluids despite vomiting; keep trying to give such patients oral fluids even if they vomit a lot.
3. Patient will certainly have surgery and general anaesthesia in the next 1-2 hours.

Do *not* give patients caffeine. Chocolate is acceptable, as are decaffeinated coffee or tea.

Even if very hungry, give patients only small bits of food to begin with. Easily digestible foods such as trail mix or gorp are ideal to start with.

K. Rehydration

1. Oral Rehydration

Patients, in addition to needing food and fluids for routine nutritional needs, may also need fluid replacement for various reasons: dehydration from excessive sweating, dehydration from vomiting or diarrhea, or shock from burns or blood loss or crush injury. Unless there is a good reason to avoid oral fluids (described above), start oral rehydration for any of these situations.

Oral rehydration fluids must contain salt. Do not attempt oral rehydration without some salt in the fluid.

Two main kinds of oral rehydration fluid are available: Oral Rehydration Salts (ORS), and "athletic" drinks such as Gatorade™. Both contain salt, sugar, and potassium, but ORS is much more salty.

For diarrhea and vomiting, or for shock from blood loss or burns or crush injury, the ideal fluid is the World Health Organization (WHO) Oral Rehydration Salts. Packets of this salt mixture, each to make a liter, are available from: Travel Medicine, Inc., 351 Pleasant St., Suite 312, Northampton, MA 01060, (800) 872-8633.

For dehydration from sweating, less salt is needed; athletic drinks (e.g., Gatorade™) are better. Dilute them half-and-half with water, or alternate a liter of athletic drinks with a liter of plain water.

If you only have ORS, it may be used for dehydration from sweating; if only "athletic" drinks available, they may be used for dehydration from vomiting and diarrhea or shock.

If you have neither ORS nor "athletic" drinks, but do have some salt, add between half a teaspoon and a teaspoon of salt per liter of fluid. (A full teaspoon of salt will result in an average "athletic" drink's salt concentration.) Salt can be added to any type of fluid.

Every medic's personal kit should contain ORS packets, Gatorade™ or similar packets, or at least some salt packets from a fast-food restaurant.

L. Hypothermia Prevention

Hypothermia prevention for rescuers is a standard part of search and rescue training and for the purposes of these protocols is not considered a medical procedure. Hypothermia prevention for patients, however, is a critical medical procedure. Even aboveground in the summer, patients with illness or injury who are immobilized or not moving are subject to hypothermia.

During or after the primary survey, rescuers of all levels shall move the patient and place available insulation under the patient, then over the patient. If the there are reasons to suspect a spine injury, the rescuer shall employ a log roll or similar technique to move the patient while protecting the spine. In certain situations (cold water immersion, severe winter storms), rescuers may legitimately consider hypothermia a life-threatening hazard and do whatever is needed to protect the patient from hypothermia even before completing a primary survey.

Rescuers should generously insulate patients unless (1) the patient complains of being too hot, (2) an unconscious or uncommunicative patient's core temperature has climbed to normal levels, as judged by a thermometer, or as judged by the rescuer by feeling the patient's skin temperature, or (3) the patient is being treated for heat illness.

In cold environments, rescuer should not hesitate to use hot packs, charcoal vests, or warm inspired O_2 or air as "active insulation" for patients who are not yet hypothermic.

M. Water Disinfection

Medics who are asked to make recommendations for backcountry water purification for drinking by patients or team members should recommend iodine tablets or other acceptable iodine methods, using adequate contact time given the temperature and turbidity of the water, or iodine-resin filtration systems.

Medics should take care to point out the limitations of most filter systems: except for iodine-resin systems, they will permit diarrhea, hepatitis, and other viruses through. And, Giardia filters will not filter out either bacteria or viruses.

For disaster situations, medics may use the following for drinking water:

- if dirty, flocculate (alum or white campfire ash)
- 8 drops Betadine®/L for 30 minutes; use more or leave longer if dirty or very cold water
- 4 cc of Clorox™ 5% bleach for 40 L (10 gallons) overnight; double if have to use in an hour

For irrigating contaminated wounds, medics should not hesitate to use clean but not sterile water. The preference, however, is for water from a filter system that removes bacteria (simple Giardia filters not useful for this purpose). There is no need to eliminate viruses from irrigation water, so most backcountry filters will be adequate for this.

N. "Clearing the Cervical Spine"

In certain wilderness or disaster situations, the risks of waiting for or using spinal immobilization are significant. In such situations, medics who have completed a Wilderness EMT class, and *only* those who have completed a Wilderness EMT class, may use the following protocol to exclude the need for spinal immobilization.

A person who has sustained a significant injury with the potential for cervical spine injury may be managed without cervical spine immobilization in the wilderness if and only if:

1. The person is alert and oriented, and not intoxicated; and
2. The person has no significantly painful "distracting injury": suspected fracture of a long bone, pelvis or skull, deep lacerations, severe contusions, large burns, or suspected multiple rib fractures; and
3. The person has no complaints of neck pain or neurological symptoms; and
4. You can find no tenderness on examination of the neck, nor any abnormality on motor and sensory exam of the extremities; and
5. The person can demonstrate a full range of motion of the neck without pain.

Rescuers may find patients in situations so hazardous that the patient must be immediately evacuated without even trying to clear the cervical spine. (Example: a patient hanging unsecured on a cliff.) This must be a decision of the rescuers at the scene, and the decision-making process *must* be documented in the rescue's medical records, even if well after the decision was made.

O. Monitoring Devices

The selection and use of monitoring devices is up to the medic. Rescuers of any level of training may place a Texas (condom) drain on male patients and attach to a urine bag either for monitoring or to keep patient dry.

V. SPECIFIC PROTOCOLS

A. Head Injury

(Blow to head *with* loss of consciousness neurological abnormalities, including confusion, memory lapses, partial paralysis)

1. Head Injury and Hypothermia

Rescuers should treat hypothermia in the setting of head injury no different from other cases of hypothermia: add as much heat as possible.

2. Head Injury and Shock or Dehydration

Rescuers should not withhold fluid from a head-injured patient with shock or dehydration. Shock or dehydration are likely to cause a worse outcome in head injury. However, rescuers should not fluid overload such a patient. Just provide fluids until signs of dehydration or shock are gone.

3. Positioning and Evacuating Head-Injury Patients

Rescuers should position a head-injury patient flat in the litter unless they must place the patient on the side to protect the airway. Regardless, the patient's head should be in neutral position with respect to the rest of the body (not twisted). Package the patient so that there is nothing even slightly constricting the jugular veins across the neck. Just slight twisting of the neck, or slight obstruction of the neck veins, may cause increased intracranial pressure.

Evacuate the patient with the head slightly up if possible.

Do not hyperventilate unless the patient is definitely becoming progressively and severely worse. Hyperventilation may cause damage to ischemic parts the brain after injury. However, hyperventilation will decrease intracranial pressure and thus may buy some time in a patient with massive brain swelling.

B. Chest Injury

Rescuers should care for chest injuries as taught by their standard prehospital emergency medical or first aid training. Particular points to observe during evacuation include two items for those with serious chest injury, and one for isolated rib fractures:

1. *Position with the good side down, and the injured side up.* This assures better blood flow to the good lung and in scientific studies provides better oxygenation.
2. *Encourage the patient to take deep breaths and cough*, even though it will be painful. Do this regularly during the evacuation, to prevent collapse of segments of the lung. Have the patient hold the injured area (or you may do this for the patient) while the patient coughs, to minimize pain. If long evacuation, use postural drainage, chest PT, as described in the section on lung infections, below (section V.W, page 8).
3. *If a team member or patient appears to have one or two rib fractures without other injury, do not splint or tape the ribs.* Provide pain medication if you are permitted to give it.

C. Abdominal Injury

1. History

Any team member with even minor abdominal injury who develops sustained lightheadedness or develops new pain in the shoulder should be evacuated from the field immediately.

2. Examination

For any team member with even minor abdominal injury, check orthostatic blood pressure and pulse as described in section IV.E.4). Evacuate immediately if team member is orthostatic.

3. Penetrating Abdominal Trauma

If evacuation and transport time to hospital will be more than an hour, *gently replace* protruding abdominal contents after irrigation with cleanest water available. Note carefully any visible tears of intestine, any fecal odor from abdominal cavity, or any visible intestinal contents in abdominal cavity. Cover wound with a dressing soaked in povadone-iodine (e.g., Betadine®) diluted with 10 parts water, then an occlusive dressing.

4. Suspected Pelvic Fracture

For WEMSI Wilderness EMT-trained individuals only: if you suspect a pelvic fracture and have gloves and lubricant available, perform a rectal exam for gross blood and in men note whether prostate is normal.

D. Back Injuries: Team Members with Back Pain After Lifting

First, check to make sure the mechanism of injury is appropriate for you to evaluate as a likely back strain. For instance, *don't* use this protocol for someone who fell 35' onto his back and has severe back pain; he or she needs to be treated as a multiple trauma patient. This protocol is only for back pain after twisting or heavy lifting.

Ask: "Have you had any trouble passing your urine?" (If the injury just happened, the person doesn't know. But, if the injury happened several hours ago, and the person tried to go and couldn't, or is dribbling all the time, you want to know about it right away.)
Ask: "Do you have any pain, numbness, tingling, or weakness going down your legs?"

If answer to either is yes, or back pain is so severe as to prevent walking, carry team member out of field.

WEMSI Wilderness EMTs only: perform exam as follows: Check sensation to pinprick between the first and second toes, and in both medial and lateral aspects of foot, ankle, lower leg, and thigh. Do this on both sides. Check motor strength in the lower leg (this can easily be done by having the person walk first on toes, and then on heels, with the toes up). Check motor strength in the thigh; this can be done by having the person try to flex and extend the knee against

the resistance of your hand. Check deep tendon reflexes in the knee and ankle. They should be about the same on both sides. Do a *straight-leg-raising test*. With the patient lying on his or her back, or sitting on a chair or equivalent, hold the thigh and knee both bent at 90°. Gently, without moving the back at all, straighten the knee. Markedly increased back pain, or increasing pain down the leg, is a positive straight leg raise test. What you are trying to do is to pull on the sciatic nerve. If it is tightly squeezed by a herniated disk or other problem, pulling on the nerve will irritate it and cause a positive test. If exam suggests herniated disk, carry team member out -- however, if no actual weakness in the leg or foot, and carry-out will be risky, may walk patient out with assistance.

E. Wounds

1. Contusions

Use standard "r i c e" treatment for first 24-48 hours: Rest, Ice, Compression (elastic bandage) and Elevation. Do not let people sleep with elastic bandages; swelling may turn them into tourniquets overnight. After 36-48 hours, apply heat, to bring more blood to area and speed healing.

2. Subungual Hematoma (blood trapped under fingernail)

Clean the nail with soap and water, alcohol, or povadone-iodine (e.g., Betadine®) and then trephine the nail (make a hole in it). The preferred method is to heat tip of a paper clip in a flame to sterilize and make red-hot, then apply firmly to nail. An alternative is to use a #11 scalpel blade to drill a hole in the nail.

3. Open Soft-Tissue Wounds

Examine the wound and classify it as either *low risk* or *high risk* for complications.

High risk wounds include: open fracture, bone or tendons exposed, human or other bites, deep punctures, grossly contaminated wound, or severe crushing.

Never put alcohol, merthiolate, mercuro-chrome, or peroxide into an open wound. Povadone-iodine may be used around but not in wounds; the only exception is diluted povadone-iodine for high-risk wounds as described below.

4. High-Risk Wounds

- Control bleeding.
- Irrigate the wound (see below).
- Leave the wound open, and pack and cover it with gauze soaked in povadone-iodine (e.g., Betadine®) diluted with 10 parts water.
- Change the dressing every six hours; *wash your hands* or wear gloves before changing dressings, and keep your mouth shut when dealing with open wounds.
- Evacuate the patient.

5. Low-Risk Wounds

- Control bleeding.
- Irrigate the wound (see below) if deep enough to require it.
- Apply bacitracin (antibiotic) ointment and a clean dry dressing. Clean the wound with drinking water and soap twice a day.
- If the wound will require surgical repair, alert Base, but there is no need for evacuation, unless the team member is unable to continue because of pain or for some other reason.

6. Irrigation

- Use water as described above under *Water Disinfection* (IV.M).
- Wounds that are the result of a cut from a clean sharp object, or from blunt force, and have not been contaminated, require only *low-pressure irrigation* with a small amount of clean water, gently sloshed through the wound.
- Wounds that have been contaminated, either from a cut from a dirty object, or from having dirt or foreign material in the wound, or delayed treatment that can allow bacteria to crawl into the wound, should receive high-pressure irrigation.
- For high-pressure irrigation, use a 30 cc syringe and 18 ga plastic intravenous catheter, or a zipper plastic bag with small hole to provide a small forceful stream.

- Use about 100 cc of fluid per inch of wound.
- Aim away from yourself and wear glasses or goggles and keep mouth closed to prevent splashing into your eyes or mouth.

7. Tetanus Status

If a team member has a wound that requires surgical repair or medical attention, and has not had a tetanus immunization within the past five (five) years, have the team member return to Base to obtain tetanus immunization.

8. Friction Blisters

Leave the blister intact unless it is in a place where it will obviously rupture (e.g., the sole of the foot).

If in area so that it is sure to rupture, make a small hole at the edge of the blister with a sterilized pin, needle, or #11 scalpel blade. Press gently to remove the fluid.

If the top of the blister is partially ripped off, trim it away neatly; clean the area and cover it with some povadone-iodine or bacitracin ointment and a self-adhesive dressing (e.g., a Bandaid™) or other dressing.
Instruct the person to keep the blister clean, since it is susceptible to infection.

9. Impaled Objects

Splinters: Wilderness EMTs only: attempt removal with a #11 scalpel blade.

Large Impaled Objects: whenever possible, you should discuss this with a Wilderness Command Physician; if you cannot contact a Wilderness Command Physician, the most experienced medic at the scene must decide whether to attempt to stabilize or to remove the object. Most impaled objects cannot be "stabilized" during a wilderness evacuation, so you should generally remove an impaled object before transport.

When removing an impaled object, you should generally remove it slowly, and gently but firmly, pulling out along the line the object entered. You should stop your attempt if you encounter any significant resistance or cause a significant increase in pain.

Fishhooks: The barbs make removing them backwards difficult. Sometimes you may be able to push the hook on through and clip off the barbed tip, allowing easy removal. When the tip is deeply embedded, it may be better to clip off most of the external part of the hook, and stabilize it in place for removal in the Emergency Department once the person reaches civilization.

F. Orthopedic Injury

1. Muscle Strains

Use standard RICE treatment for the first 24-48 hours: Rest, Ice, Compression (elastic bandage) and Elevation.

Do not let people sleep with elastic bandages; swelling may turn them into tourniquets overnight.

After 36-48 hours, apply heat, to bring more blood to the area and speed healing.

For spasms or cramps or stiffness, use gentle stretching after applying heat.

2. Probable Sprains

Minor injuries that appear to be sprains, and do not interfere significantly with use of the part, should be treated with RICE treatment for the first 24-48 hours: Rest, Ice, Compression (elastic bandage) and Elevation.

Do not let people sleep with elastic bandages; swelling may turn them into tourniquets overnight.

After 36-48 hours, apply heat, to bring more blood to the area and speed healing.

For more significant sprains (or possibly minor fractures) management depends on the medic's level of training:

First Aid/First Responder level: splint and evacuate.
Wilderness EMT level and above: evaluate and treat in accordance with Wilderness EMT training. Some team members with such injuries will need to be splinted and evacuated, others may be taped and walk out, and still others may be splinted or taped and continue with the task.

3. Closed Fractures:

There are two indications for your realigning a deformed long bone fracture (including open fractures). They are (1) to correct or at least improve a sensory or vascular deficit secondary to the fracture (if numbness, tingling, weakness, or lack of pulse beyond fracture), and (2) to align severely deformed long bone fractures to allow splinting with adequate immobilization.

Don't try to reduce (set) the fracture or force all the bone fragments back into anatomic alignment. This is a physician's responsibility.

Pull longitudinally, that is, along the normal axis of the injured extremity. Grasp the extremity distal to (beyond) the fracture firmly. Once you apply traction, you will not release it until the limb is fully splinted. Have an assistant stabilize by countertraction, holding the extremity proximal to (closer to the torso than) the fracture. Use the least amount of force needed to align the extremity. Having a person support the injured extremity under the site of the fracture will make the patient more comfortable. Your initial pull will usually cause slight discomfort as the fragments move, but it quickly subsides. Then, you can apply further gentle but firm traction to align the fracture. If the patient strongly resists traction, or if it causes markedly increasing pain that continues, stop, and splint in the deformed position.

Attempt realignment of a long bone fracture only twice, unless there is a sensory or vascular deficit. If you are unsuccessful after two attempts, or if you encounter resistance during realignment, splint the extremity as is. In these circumstances there is a greater risk of making the injury worse than the potential benefit of the realignment.

4. Femur Fractures

For the initial management of a femur fracture, use a traction splint.

Even with the best-padded ankle hitches, traction splints tend to cause pressure necrosis when used for a long period of time. You must monitor carefully for signs of pressure necrosis, and readjust or take off the traction splint if the ankle shows signs of skin breakdown. If the evacuation will be more than three or four hours, use *skin traction* instead of an ankle hitch: apply tincture of benzoin (Friar's Balsam) to the calf on both sides, then run a piece of duct tape in a "U" shape under the instep and up along both sides of the calf; fold the section under the instep over on itself so it does not stick to the skin. Attach the traction to the duct tape under the instep.

Many orthopedic surgeons doubt the usefulness of traction splinting for extended evacuations. Instead, they recommend a Jones' dressing: bulky padding surrounded by plaster, fiberglass, or flexible SamSplints™, and held together with elastic bandages. If no traction splint is available, apply a Jones' dressing.
If none of these splints are available, transport the patient supine on a well-padded backboard with the legs strapped together or with a tree limb or another reasonable substitute secured between them.

5. Open Fractures

Realign open fractures for the same reasons as for long bone fractures as described above.

Open fractures deserve special consideration. You must arrange immediate evacuation for any patient with an open fracture. These fractures require irrigation, debridement, and open surgical reduction in the operating room. You must assume that any fracture (or suspected fracture) with a nearby laceration or wound is an open fracture. Care of open fractures in the wilderness environment depends upon evacuation time.

If you estimate that you can complete evacuation within six hours, limit cleansing to just brushing off dirt and other contaminants with clean gauze or a cloth and apply a dry, sterile dressing. Control hemorrhage by carefully applying a pressure dressing and immobilize the extremity by splinting.

If evacuation time will exceed six hours, you should clean the wound, perform limited debridement (trim away any obviously dead tissue), and irrigate as described for wounds, above, before applying a sterile dressing. Control hemorrhage with a pressure dressing, and immobilize. If you find evidence of any nerve or vascular deficit (numbness or missing pulse), and the extremity is deformed, realign the fracture and reevaluate before splinting and evacuating.

6. Dislocations

First Aid/First Responder level: attempt reduction only if numbness, or if no pulse beyond dislocation.
Wilderness EMT level: attempt reduction of all dislocations if numbness, or if no pulse beyond dislocation. Attempt reduction of the following dislocations: jaw, finger or toe, elbow, shoulder, patella, knee, ankle. Attempt hip dislocation reduction only if needed to evacuate patient.

7. Amputations

Control hemorrhage by direct pressure. Clean the amputated part with water or saline, wrap it in a moistened sterile gauze or towel, place it in a plastic bag, and transport it as cool as possible without freezing it. Never place an amputated part in direct contact with ice or icy water. Keep the amputated part with the victim throughout the evacuation process.

G. Heat Illness

1. Syncope (Fainting, Passing Out)

Syncope may be a sign of serious medical problems, such as a seizure disorder, a heart valve problem or arrhythmia, or a stroke. On the other hand, fainting may be due to minor problems, such as dehydration, a sudden psychological shock, prolonged standing, or forgetting to eat breakfast.

If you are on a wilderness SAR task and find yourself confronted with a team member who has had a syncopal or near-syncopal episode (passing out or nearly passing out), evaluation depends on level of training.
First Aid/First Responder level: evacuate team member.
WEMSI Wilderness EMTs only: You may allow a team member who meets the following criteria to resume duties after a few minutes' rest and some rehydration and sugar replenishment:

- the team member had some lightheadedness or nausea prior to the episode;
- the team member was unconscious for only a few seconds;
- the team member has no history of heart problems, and had no chest pain or chest pressure associated with the episode;
- the team member had no specific neurological symptoms;
- no seizure activity was noted, nor anything to suggest a seizure (no tongue biting, no urinary or fecal incontinence;
- no significant injury occurred to the team member from falling; and
- on exam, you can hear no heart murmur, you find a regular pulse, and you find a normal neurological exam.

You should use the above protocol with caution; anything about the episode that makes you suspicious that it was not heat syncope, even if the team member meets all the above criteria, should be cause to terminate the task and head back to base.

Any team member with syncope should be examined by a physician when the team returns to base, even if you have cleared the team member to continue with the task.

For all levels of training:

You should carefully check the team member for orthostatic changes in blood pressure (or pulse, if you do not have a blood pressure cuff), and should continue rehydration and sugar replenishment until the person is no longer orthostatic.

2. Heat Cramps

Treat heat cramps with gentle stretching and oral rehydration as described in the section on oral rehydration, above.

3. Dehydration

If you suspect dehydration in a team member (common symptoms are: lightheadedness, weakness, nausea, redness of vision or tunnel vision):

- Ask the team member to urinate. If he or she can produce only a small amount of dark urine, he or she has at least mild dehydration.
- Check for orthostatic changes in pulse and blood pressure to look for severe dehydration.
- Check patient's temperature to rule out heatstroke.

- Rehydrate as described in the section on oral rehydration, above.

4. Heat Illness (Heat Exhaustion, Heatstroke)

If a patient or team member has a temperature more than about 101°F (38°C), with neurological symptoms (e.g., confusion, decreased level of consciousness, weakness or numbness or tingling of one leg or one arm), in a proper setting for heat illness, and without history or physical exam evidence to suggest fever, treat for heat illness:

Rehydrate if any suspicion of dehydration, place in cool area, dampen the patient's clothes with water (preferably tepid, not cold), and fan to cause evaporation heat loss. You may place cold packs at sides of the neck, in armpits, and in groin.

Use cooling to bring temperature down to 102°F (39°C), then stop. Monitor temperature for decreases or increases. Evacuate. If you have no thermometer, and patient feels hot and seems to have heat illness, treat for heat illness.

H. Burns

1. Small Second or Third Degree Burns
(Burns the size of five palms, which is about 5%, or less): Gently clean the burn of loose blister fragments, and any foreign material, clean the burn with soap and water, and apply silver sulfadiazine (Silvadene®) cream or bacitracin ointment twice a day. (If you don't have silver sulfadiazine (Silvadene®) or bacitracin, canned non-mentholated shaving cream makes an acceptable substitute.)

Leave complete blisters intact, unless they are where they are sure to rupture (e.g., the soles of the feet), or are very large and tightly filled with bloody fluid. In such cases, prep the blister with povadone-iodine (e.g., Betadine®), then drain by a small incision at the edge of the blister with a sterile scalpel blade or needle. Press the blister flat, in the hope that it will stick to the underlying skin and continue to serve as a burn dressing. Apply a dry dressing.

2. Large Burns
Treat the burnt area as described for small burns, above.

Evaluate carefully for shock, and be prepared to give large amounts of fluid by mouth if tolerated. Use urine output to gauge adequacy of fluid replacement.

Evaluate for airway burns and toxic inhalation.

I. Lightning Strikes

A particularly important point about lightning strikes is that the patient may have *respiratory paralysis, unconsciousness, and vasospasm with undetectable pulses; despite which, prolonged artificial respiration may allow the patient to recover with no neurological deficit.* (Vasospasm is a "cramp" of blood vessel muscles that may make a pulse impossible to feel.) Coma may last for days or weeks, but some patients will still make a full recovery. Each lightning strike victim needs immediate ABC's, with careful attention to protecting the C-spine. Almost all trauma patients and many cardiac patients with cardiac arrest will die even if you apply CPR. Lightning strike victims, on the other hand, offer you an excellent chance to save a life through basic life support.

If you find a patient in or near a thunderstorm, with coma, dendritic burns, or ruptured eardrums, you should start vigorous resuscitation, for the patient may be a lightning victim.

Anyone you find confused near a lightning strike might be a victim of the strike. You should check for pulses (remember the possibility of vasospasm) and check the BP. Perform a regular trauma exam; if you have an otoscope, check for tympanic (eardrum) perforations. Although such patients are generally stable, and recover without incident, evacuation is in order, with cardiac monitoring if available.

Check the patient's urine for signs of myoglobinuria (see below) and treat it if found. If you must triage a group of people who have been hit by lightning, the rule should be ‘‘resuscitate the dead,’’ because those showing some signs of life are likely on the way to recovery.

J. Hypothermia

1. Mild Hypothermia

Hypothermia is divided into deep and mild by the temperature 90°F (32°C). Those with mild hypothermia and no medical problems can be rewarmed by any method and will do well. Team members with mild hypothermia may return to duty after rewarming and adequate food and drink.

2. Treating Hypothermia

When caring for a hypothermic patient in the field, add as much heat as you can, using any and every method available. Try to rewarm the core first. Acceptable methods include warm IVs, warm fluids by mouth if the patient can take them, hot packs at lateral neck, armpits, and groins, warm humidified air or O_2 and rewarming devices such as a charcoal vest. However, don't delay evacuation to rewarm the patient. Also provide fluids and food calories if you can.

3. Handling Hypothermic Patients

- Handle hypothermic patients gently to prevent ventricular fibrillation (cardiac arrest).
- Do not let hypothermic patients exert themselves during rescue.
- Carry hypothermic patients flat or in the slightly head-down position.
- Hypothermic patients, especially those with subacute (=exhaustion, mountain, or cave) hypothermia, are very fluid depleted, and need fluids.
- Those who have been hypothermic for a long time (days) may have trouble handling large fluid loads, because of "stiffness" of the heart. In such cases, you must monitor carefully for signs of fluid overload when giving fluids (lung congestion, ankle or lower back swelling).

4. Hypothermia and Possible Cardiac Arrest

- If you come upon a cold and apparently dead person, you may start artificial respiration but should not start external cardiac compression if there are any signs of life. Check for three (3) minutes for pulse, heartbeat, and respiration. Check for a rhythm with an EKG monitor if you have one. If there is an organized rhythm, even as slow as 20, you may start artificial respiration but don't start external cardiac compression.
- Use normal rates for artificial respiration and external cardiac compression. Give O_2 if available.
- Severely hypothermic patients in cardiac arrest may survive long periods without cardio-pulmonary resuscitation, if necessary for rescue. If CPR must be interrupted for periods up to 20-30 minutes during rescue, do so, and resume CPR afterwards. (E.g., during evacuation through a small crawlway in a cave.)
- If you have a hypothermic patient who has no detectable signs of life, consider transport to a facility that can perform bypass rewarming; call ahead early to alert the facility.

5. Special Hypothermia ALS Notes for Paramedics

It is difficult or impossible to defibrillate deeply hypothermic patients.

Arrest and Core temperature > 30°C (86°F): use standard ACLS protocols.

Arrest and Core temperature < 30°C (86°F): May try bretylium (if available) and defibrillation, but don't give other ACLS drugs, particularly procainamide.

Core temperature < 30°C (86°F) but not in arrest: If bretylium becomes available (no longer made as of early 2001), call a Wilderness Command Physician for an order to give a single dose of 350 mg of bretylium slow IV push to prevent ventricular fibrillation during evacuation.

The criteria for endotracheal intubation are the same for normothermic and hypothermic patients. Intubation does not put hypothermic patients at any more risk of ventricular fibrillation than normothermic patients.

If your hypothermic patient has atrial fibrillation, atrial flutter, PVCs, or various kinds of atrioventricular block, don't treat them; specifically, don't give atropine and don't use a pacemaker.

K. Submersion (Near-Drowning)

Cold water submersion (near-drowning) is *not* the same as acute (immersion) hypothermia; the treatment for the two is very different.

Do not rewarm victims of cold water submersion; keep them cold.

L. Frostbite and Immersion Foot

1. Superficial Frostbite (Frostnip)

- Frostnip commonly affects fingers, toes, ear lobes, and noses, and you can recognize it by a sudden blanching of the nose, ear, or fingertip. Although the part is pale or yellowish, it is still soft to the touch, not hard or woody as in deep frostbite. Numbness is not a useful symptom for diagnosing frostnip. A frostnipped area may be numb, but cold skin is numb well before it becomes frostnipped.
- Treatment of frostnip is simple: rewarming by a warm hand over the nose or ear, or by placing a frostnipped finger in the mouth, in an armpit, or in a warm pocket. On rewarming, the affected part tends to turn red, painful, and possibly slightly swollen, but no permanent damage results. Providing a warm armpit for a friend's frostnipped toes is supposedly a mark of true friendship. Oxygen is of no proven benefit, but you may administer it if readily available.

2. Deep Frostbite

- In deep frostbite, the subcutaneous tissues are frozen solid, and the affected part feels hard, like a piece of wood or frozen meat.
- The first thing to remember is to check for life-threatening hypothermia before treating frostbite. Generally, you can safely treat both frostbite and hypothermia at the same time. (However, if faced with an unstable patient with both frostbite and hypothermia, you might want to delay rewarming of the frostbitten extremities until the patient was stable.)
- The best "street" treatment is to transport rapidly to a hospital where definitive rewarming can occur. However, when the rescue team cannot begin transport for a long time, or there is a long transport time to the hospital (more than an hour), you should rewarm en route. If the patient is hypothermic, rewarm the core and protect the patient from further cold exposure before worrying about frostbite. However, *there is no justification for keeping the frostbitten part cold during transportation.* Rapid rewarming is better than slow rewarming, so some recommend applying cold packs to a frostbitten limb, or leaving it out of the patient packaging during evacuation. This is ridiculous. The chance of causing more extensive frostbite far outweighs any potential advantage of "preventing slow rewarming" during transport. Indeed, studies show that slow rewarming (e.g., room temperature air or a warm sleeping bag) is better than very slow rewarming (e.g., ice water bath, or leaving the frostbitten limbs cold).
- The proper definitive treatment, in the hospital or in the field, is rapid rewarming in 105-110°F (41-43°C) water.
- Patients must *not* smoke, because of the vasoconstrictor effect of tobacco. Caffeine may also have a vasoconstrictor effect, so don't give the patient caffeine (coffee, tea, or cola drinks).
- Folk and medical traditions worldwide used to recommend slow rewarming. There were several reasons for this. First, the writings of Hippocrates can be interpreted as warning against rapid rewarming. Such classical sources were highly regarded in Europe in the Middle Ages, from which we obtain much of our folklore and medical superstitions. Second, rapid rewarming often meant rewarming in front of a fire, which can cause uneven heating and cause burns. This is probably the reason Napoleon's surgeon general, Baron Larrey, recommended against rapid rewarming. Third, slow rewarming is much less painful than rapid rewarming, and with

rapid rewarming, the parts become more red and swollen. Nonetheless, the final tissue loss is less with rapid rewarming. So, regardless of what you hear about slow rewarming by rubbing with snow or immersion in ice water, *use rapid rewarming.*

- *Frostbitten limbs are numb*, so don't cook them in too-hot water, or burn them by rewarming in front of a fire. If you don't have a thermometer, your elbow makes an adequate improvised replacement. Hold your elbow in the water for a few minutes. It should feel very warm but not painful. (Fingers and hands are not as accurate for checking absolute temperature. Think of how hot even cool water feels on your hands after you've been out in the cold for a while.)

3. Frostbite in Litter Patients

Wrap the frostbitten extremities in towels or thick pieces of clothing soaked with warm (40-42°C = 104-110°F) water. Next, wrap waterproof plastic and pieces of closed-cell foam around the towel-wrapped extremity, then place the patient in the litter. A liter of water can be quickly heated on a stove while the patient is prepared for evacuation. The water will cool during evacuation; this is acceptable. There is no benefit to providing continued warmth once the frostbitten part has rapidly thawed. If the evacuation will be very long, you may want to take the wet towels off several hours later to allow the skin to dry.

Heat packs and heating pads are well-known for the burns they cause during rewarming, sometimes even to extremities that were not truly frostbitten. If it is so cold that you must use heat packs to prevent the wet towels from cooling too fast, even when insulated, make sure the hot packs aren't in direct contact with the skin.

Some might argue against thus treating frostbite in a patient who is also hypothermic. True, rewarming of the periphery should be avoided in hypothermia, but the hands and feet (not the arms and legs) have direct venous connections to the core, so rewarming of the hands and feet is quite acceptable, even if the patient is hypothermic.

M. Altitude Illness

1. Acute Mountain Sickness

At altitudes above 4000 feet, may suspect acute mountain sickness, especially if rapid ascent to altitude, and symptoms of headache and nausea, and many symptoms of alcohol hangover, or a migraine headache:

- tiredness, malaise, and drowsiness;
- weakness and dyspnea on exertion;
- anorexia (loss of appetite); and
- difficulty sleeping, often including prominent periodic ("Cheyne-Stokes") breathing, with waxing, waning, and periods of apnea.

Severe acute mountain sickness recognized by increasing neurological symptoms, including confusion, ataxia (an abnormal walking gait), and grades into high altitude cerebral edema.

Treatment of acute mountain sickness: *Stop ascending or go down.* Mild AMS may be a harbinger of worsening AMS to come if the rate of ascent stays the same. After the symptoms have gone, ascend at a slower rate. For more severe AMS, a descent of 500-1000 meters (1500-3000 feet) is adequate. If the patient recovers completely, he or she may safely reascend (gradually), but with the understanding that he or she is predisposed to altitude illness.

2. High Altitude Cerebral Edema

The most reliable sign of developing high altitude cerebral edema is *ataxia.* Ask the patient to walk a straight line, placing the heel of one foot directly in front of the toes of the other foot. At altitude, anyone who is not otherwise intoxicated, and who cannot walk the line, must descend as soon as possible.

Later stages of HACE usually show increasing somnolence and coma, followed by death.

For patients with altitude illness and significant neurological symptoms, the only accepted treatment is to go back down.

3. High Altitude Pulmonary Edema

Early high altitude pulmonary edema (HAPE) is characterized by a dry cough, decreased exercise tolerance, and intermittent slight shortness of breath and chest tightness, usually at night. Onset is usually slower than acute mountain sickness, usually occurring from the second to the fourth day after starting the ascent, or arriving at elevation.

Hypoxia from HAPE may cause confusion, neurological symptoms, or even coma, all without shortness of breath. Patients with more severe HAPE often develop frothy sputum. Once a patient becomes unconscious from HAPE, death usually ensues in 6-12 hours.

For patients with altitude illness and severe pulmonary symptoms, as for those with severe neurological symptoms, the only accepted treatment is to *go back down*.

N. Snakebite

1. General

Do not use electric shock, pack in ice, or use any other snakebite treatments except for those given here.

2. Coral Snake Bites

- Coral snakes only occur as far north as the Great Dismal Swamp on the eastern Virginia-North Carolina border, and bites are very rare.
- If within 30 minutes of the bite, use a Sawyer Extractor™ (see below). If the patient is very young, very old, or very ill, use the Australian treatment:

3. The Australian Treatment

In Australia, highly-toxic bites are more common than in the U.S. The venom of Australian snakes is deadly but causes little local tissue damage. For such snakebites, an arterial tourniquet might be lifesaving. However, because of the pain and damage caused by an arterial tourniquet, Australians searched for better first aid treatments. These ''Australian'' techniques use less-painful methods to immobilize venom at the site of the snakebite. The ''CSL'' technique, named after Commonwealth Serum Laboratories, where the principal researchers work, is simple: use an elastic bandage or roller gauze, wrapping firmly but not tightly (pressure of 55 mmHg) proximally most of the way up the arm or leg, then immobilize the limb in a splint. This decreases the blood flow in the area around the bite, theoretically limiting both the spread and absorption of the venom. This might then permit the victim to survive until you can get antivenin. Another group of Australians argue that using a firm pressure dressing over the bite (pressure of 70 mmHg) works better than an elastic bandage, and have done experiments in humans that support this. One animal experiment seemed to show that the CSL treatment worked for North American rattlesnake bites, but Dr. Findlay Russell of the University of Arizona says he has seen a number of patients whose rattlesnake bites were made much worse by this treatment. Therefore, the best evidence is that for North American pit vipers, this method causes severe local tissue damage and you should *not* use it unless willing to sacrifice the limb to save a life.

If you are on a disaster response to a country with very poisonous snakes, you might use the CSL treatment for envenomated bites.

4. Pit Viper (Rattlesnake, Copperhead, Water Moccasin/Cottonmouth)

- Have the patient lie down and relax; give no alcohol. (It causes vasodilation and may speed venom absorption.) Remind the patient (and yourself) that the fatality rate even for *untreated* pit viper bites is extremely low.
- Use a Sawyer Extractor™ if available and within 30 minutes of the bite. Do not use a Cutter™ snakebite kit, or make any incisions.
- Any snakebite is a contaminated puncture wound, and you must treat it as such. (See the discussion of wounds, above.)
- Only a few snakebites are from poisonous snakes, and only a certain number of bites by poisonous snakes leave venom in the skin or muscle (are *envenomated bites*); only those bites that are from poisonous snakes and that are

envenomated need treatment for snakebite poisoning.

- The major risk from snakebite is loss of a limb, and erroneous treatments such as packing in ice have resulted in more loss of limbs than from snakebite itself; this is particularly tragic when limbs have been lost to frostbite because of a non-envenomated bite.
- Pit viper venom is injected through half-inch long fangs; if there are no fang marks, it is most unlikely that any venom was injected. Even if there are fang marks, venom may not be injected. If there is no severe local reaction of pain, swelling, and tenderness, nor a metallic taste in the mouth, then the bite was probably not envenomated, and need not be treated as a poisonous snakebite.
- Observe for myoglobinuria (see section IV.M, page 25) and treat if necessary.

O. Beestings

Apply ice to sting to reduce pain. See also anaphylactic reactions under Allergic Reactions (see section V.GG, page 24).

P. Rabies

If person is bitten by mammal (other than rodents, squirrels, or rabbits), that might potentially be rabid, or contaminated by its saliva:

- Attempt to capture or kill the mammal if you can do it *without risk of additional bites*. Do not damage the brain, as it is needed for testing for rabies. Arrange for the head to be taken to a public health service laboratory.
- You can reduce the amount of virus in a bite wound, and thus the possibility of infection, by scrubbing the wound briskly with a scrub brush. Use alcohol and soap if they are available. Although you are taught never to put strong antiseptics or alcohol into wounds, mammal bites are an exception. Alcohol has been shown to kill the virus, and soaps will help remove the virus. Scrub the bite or wound vigorously with a scrub brush or gauze pad. Use both alcohol and soap if available.
- After scrubbing the wound, immediately evacuate the patient for possible postexposure vaccination. If the patient has already been vaccinated for rabies, the need for evacuation depends on the wound itself (discussed under wounds, above).

Q. Headache

For a team member complaining of a significant headache:
WEMSI Wilderness EMTs: evaluate with a careful history, a detailed exam of the head and neck, and a neurological exam. If patient has neurological symptoms (confusion, visual disturbances, weakness, numbness, or tingling in an arm or a leg), a stiff neck, a fever, or it is the worst headache the person has ever had, evacuate urgently. For other headaches, assess the possibility of serious causes; evacuate at a routine pace if you think indicated, or let team member continue with task. Consult with Wilderness Command Physician if possible.
All other levels of provider: If patient has neurological symptoms (confusion, visual disturbances, weakness, numbness, or tingling in an arm or a leg), a stiff neck, a fever, or it is the worst headache the person has ever had, evacuate urgently. Otherwise, evacuate at a routine pace.

R. Foreign Body Sensation in Eye

Examine the eye, starting with checking visual acuity, then evert the eyelid if trained to do so, and gently remove any foreign bodies seen on the eyelid or conjunctiva (white part of the eye) with a cotton applicator (Q-Tip™) or improvised equivalent. Use irrigation with clean water to attempt to remove foreign bodies from the cornea (clear part of eye). If foreign body sensation persists, and medications available, give pain medication (if needed) and place antibiotic ointment in eye. Do not patch the eye. Evacuate at a pace determined by the patient's discomfort level.

S. Nosebleeds

Use direct pressure to pinch the nostrils together firmly, as close to the face as possible. Use uninterrupted pressure for 10 minutes then recheck. Hold for another 10 minutes if still bleeding. Have the patient sit forward during pressure. Check the back of the throat with a penlight for a thin trickle of red blood indicating continued bleeding.

If bleeding persists, *pack* the nose with gauze. Roll up a small gauze pad (*not* a tissue or paper towel that will partially dissolve) and place it in the bleeding side of the nose to aid in direct pressure. It will also serve as a pressure dressing once pressure is released. If you have double-compressed nasal tampons, you may use these instead of gauze. To avoid infections, leave packing in place for no more than 1-2 days.

If unable to control bleeding (remember to check back of throat for thin trickle of red blood indicating continued bleeding), treat as for uncontrolled bleeding elsewhere: treat for shock and evacuate urgently.

T. Dental Injury

If the tooth is completely out of the socket (a complete avulsion), you may rinse dirt off it. But, don't scrub it, even with a gauze pad, as this will destroy the delicate layer of cells that will allow it to reattach. Further treatment depends on the time until you can reach a dentist or oral surgeon. If you are within an hour or two of a dentist or oral surgeon, and a tooth is completely out, keep it moist so that an oral surgeon can reimplant it. Keeping the tooth in the patient's cheek is ideal, since the patient's own saliva is the best protection.

If you are distant from a dentist or oral surgeon, replace the tooth in its socket as soon as possible. Apply some dental splinting material to keep the tooth in place if you have some. A large wad of chewing gum often works fairly well as a dental splint.

No matter the distance to the dentist or oral surgeon, you must assure that the patient doesn't aspirate the tooth. If the route out involves some difficult climbing, or if the patient is only semiconscious, don't put the tooth in the mouth. Instead, place it in a gauze pad dampened with the patient's saliva and a bit of clean water or saline, then put it in a plastic bag. Evacuate the patient immediately but not urgently, unless there are other severe injuries.

U. Chest Pain

WEMSI WEMTs: If an episode of chest pain in a team member is clearly due to trauma or a muscle strain, or to gastroesophageal reflux, or to pneumonia or bronchitis, the team member may walk out or continue with the task. If there is any doubt, treat as a possible myocardial infarction and proceed with an evacuation. Any team member who had chest pain in the field should be evaluated by a physician on return to civilization.

All other level of providers: evacuate patient.

V. Asthma

If a team member has an asthma exacerbation, first ask if the patient has his or her own medicine to take. Several cups of coffee, tea, or caffeine-containing soft drink will help asthma, though side effects are prominent (sweating, tachycardia, tremor, irritability). If the team member shows signs of severe respiratory distress, and an Epi-Pen™ is available, show the team member how to use it, and assist if necessary.

W. Lung Infections

Treat suspected pneumonia or bronchitis the same:

- Postural Drainage is designed to help bring up lung secretions in those who are having difficulty doing so on their own. This includes those who are very weak from exhaustion, starvation, severe illness, or other injury. The technique is simply to assess where the pneumonia or secretions are located in the chest, and then position the patient with this part uppermost (i.e., on one side). Tilt the patient in the slightly head-down position. If you can't tell which side is the source of the phlegm, have the patient alternate lying on the left and right sides.
- Chest PT (strictly speaking, chest PT includes a variety of techniques,

however, it is commonly used to refer to clapping) is pounding moderately on the chest, with cupped hands. The action comes from the wrist, with alternate clapping of the hands. You may use a minute of this clapping every hour or two.
- Deep Breathing Exercises help in clearing secretions from the bronchial tree. By directing the patient very specifically in expanding the lungs, you may encourage the patient to take a deeper breath, opening sections of the lung to drain.
- Coughing is an important method of clearing secretions. Because of pain or tiredness, patients may not want to cough. By explaining and encouraging coughing, you can promote drainage. Have patient hold the chest or painful areas to protect them from severe pain during coughing.
- If the patient is sick enough to need chest PT and deep breathing/coughing exercises, you should evacuate promptly but not hastily.

X. Deep Venous Thrombosis

A classic deep venous thrombosis (clot) in the leg is characterized by swelling in one (and only one) leg and ankle, with mild redness and warmth. The calf is swollen compared with the unaffected calf and is tender to deep palpation (compare with the unaffected calf). If the foot is forcibly dorsiflexed (pushed up), the resulting traction on the calf may cause pain. Sometimes, you can feel the tense, clotted veins behind the knee or in the upper calf or posterior thigh ("cords"). If there is any suggestion the patient might have a deep venous thrombosis, don't let the patient walk out. Walking on the leg could make a piece of clot break off and go to the lung, causing a pulmonary embolism, possibly killing the patient. Evacuate with the leg elevated and keep it warm with heat packs. (We think heat will help the body reabsorb the clot.)

There are several things you can do to prevent deep venous thrombosis in litter patients, who are often at high risk for multiple reasons: trauma, immobilization, or dehydration. If the patient is conscious, you can prompt the patient to alternately tighten and relax the legs. If you have a long wait because some of the rigging isn't ready, and the patient doesn't have a suspected spine injury, untie the patient and let him or her move around a little. Try to hydrate the patient as best you can. There is one final thing that you can do. *Be careful of your leg tie-in.* Anything tight around the leg or ankle will decrease venous flow and promote clotting. If you can leave room for the patient to wiggle his or her legs, that's even better.

Y. CPR

Always start CPR in a pulseless victim well away from a road unless one of the following contraindications is present:
- If cardiac arrest is due to trauma;
- If a drowning victim has been immersed for more than an hour, even in cold water;
- If Advanced Cardiac Life Support is more than an hour away;
- In cases of unwitnessed cardiac arrest, when there is no way of knowing when it began;
- Persons who appear dead because of:
  * Rectal temperatures that are the same as that of the environment;
  * Rigor mortis or dependent lividity; but, only in a non-frozen patient; or
  * Lethal injuries, such as decapitation, massive head or chest injuries, severed trunk.

In the backcountry, discontinue CPR if, after 30 minutes of effort, you can detect no evidence of spontaneous pulse or respirations, and if CPR cannot be continued throughout the evacuation. For certain situations, the possibility of resuscitation with Basic Cardiac Life Support is high, so continue CPR for more than half an hour:
- Cold water immersion less than an hour (hypothermia and possibly the mammalian diving reflex tend to slow metabolism)
- Avalanche burial;
- Arrest after known hypothermia;
- Lightning or arrest secondary to electric shock.

Z. Abdominal Pain

1. Acute Abdomen:

Anyone with severe abdominal pain, spasm of the abdominal wall muscles (guarding), and exquisite tenderness of the abdomen has an "acute abdomen."

Evacuate anyone with an acute abdomen as quickly as possible, because the patient might need surgery.

Give nothing to eat or drink. The patient with an acute abdomen will probably not absorb anything you give. He or she is likely to vomit during the evacuation, or regurgitate and aspirate during anaesthesia once the patient reaches the operating room.

For pain control, transport with the hips and knees bent to relieve some pain from abdominal wall muscle spasm.

2. Less-Severe Abdominal Pain

WEMSI Wilderness EMTs only:

- Milder abdominal pain does not need to be managed so aggressively, but you need to do a careful history and physical exam.
- If you can discuss the case with a Wilderness Command Physician, follow the Wilderness Command Physician's orders regarding evacuation.
- Otherwise, you must form a tentative diagnosis, at least as far as the severity of the problem, and decide whether to evacuate or not based on the diagnosis.
- Repeated abdominal exams (e.g., every 2-3 hours during the night if stationed at a camp-in, or during a continued task) are probably your best tool to decide how serious the problem is.

Other provider levels:

- Evacuate immediately.

AA. Vomiting and Diarrhea

1. Motion Sickness

Instruct person to fix vision on the horizon or on a distant object.

2. Gastroenteritis:

- Gastroenteritis is a general term for irritation of the stomach or intestines, which may result in cramps, diarrhea, or vomiting.
- The most serious consequence of diarrhea is dehydration, which may even progress to shock. Therefore, the most important treatment for diarrhea is fluid replacement. (Oral rehydration is discussed above, see section V.Z.1, page 7.)
- After infectious diarrhea, adopting an appropriate diet may prevent the diarrhea from lingering. Start clear fluids as soon as possible, even if patient is still vomiting, because they are almost totally absorbed, leaving no residue to form stool and prompt an unwanted bowel movement.
- If patient tolerates clear liquids, the victim may start eating as soon as possible. Food will stimulate regeneration of intestinal enzymes, and will increase water absorption. Easy-to-digest starches will actually decrease the diarrhea. Bread, toast, crackers, rice, potatoes, and cooked vegetables are good to start with. For young children and infants, the BRAT diet is commonly recommended: Bananas, Rice cereal or noodles, Applesauce, and Toast. Muesli/Granola bars are commonly available in SAR packs and are a reasonable alternative.
- Avoid greasy foods, as diarrhea washes out the digestive chemicals needed to absorb fat. Avoid spicy foods that tend to cause loose bowel movements at the best of times (e.g., barbecue sauce or Thai food). Diarrhea washes certain enzymes out of the gut, and it takes three or four days for these to regenerate. Eating foods that require these enzymes will cause diarrhea, even if the infection is gone. The enzymes are those responsible for absorbing *fruit and milk sugars*, so avoid these sugars. Avoid

milk, milk shakes, ice cream, or fresh fruit or fruit juices for three to four days. The victim may eat and drink items containing table sugar, as found in sherbet, gelatin desserts, and soda drinks, and dextrose, as found in Gatorade™ and similar drinks.

BB. Urinary Tract Infection

The classic symptoms of cystitis include:

- dysuria (burning on urination);
- frequency of urination; and
- urgency of urination (having to go *right now*).

Other symptoms may be associated with cystitis:

- incontinence of urine (dribbling of urine, especially with coughing or sneezing); and
- blood in the urine ("hemorrhagic cystitis")

Instruct any person with suspected cystitis to drink *lots* of fluids and to urinate frequently in an attempt to wash out the infection. Evacuation is not necessary unless the patient's discomfort requires it.

If a person with suspected cystitis develops fever or significant back pain, evacuate immediately.

CC. Testicular Pain

Men may develop pain in the testicles without direct trauma. All such cases should be evacuated, except that WEMSI Wilderness EMTs may try to determine if there is testicular torsion, and attempt to untwist the spermatic cord.

DD. Vaginal Bleeding

If a team member has (a) small amounts of unexpected menstrual bleeding, or (b) during expected menses has more than normal menstrual flow but less than a pad an hour and no pain worse than usual menstrual cramps, check orthostatic vital signs. If she has normal orthostatic vital signs, she may continue with the task.

If the flow is more than usual but no more than to soak a pad every hour or so, or if the pain is more than the team member's usual menstrual period cramps (*dysmenorrhea*), but not orthostatic and no increased pain, send her back to base.

If the flow is more than a pad an hour, or if she is orthostatic, evacuate immediately.

EE. Kidney Stones

If you suspect a team member has a kidney stone, arrange for immediate evacuation; if unable to give pain medications yourself, consider asking for a more advanced provider to respond into the field to provide pain relief so the team member will then be able to exit without being carried out. Have the person strain the urine to try to collect the stone, and have the patient take the stone to his or her family doctor.

FF. Diabetes

Standard first aid training teaches that any sick diabetic should be given sugar, because it will make insulin shock better and will not harm someone who is hyperosmolar or in ketoacidosis.

If a diabetic does not improve with sugar, start oral rehydration, preferably with WHO Oral Rehydration Solution (see oral rehydration, above).

GG.Allergic Reactions

Some allergic reactions, especially to bee and wasp stings, may cause a severe allergic reaction, sometimes severe enough to kill in seconds.

Some people may have *a generalized allergic reaction* to things such as certain medications, stings, plants, foods, or other materials in the environment. This reaction is not limited to the area of contact with the allergen. Its most prominent sign is an itchy rash. With some allergies, especially those to medications, the rash may be made up of many flat, itchy, red macules (tiny patches). In other cases, a wheal-like rash (hives: like mosquito bites without the bite), which may occur over the entire body.

Anaphylactic reactions are characterized by wheal (hive) formation that is very severe. As with milder urticaria, the primary problem is leaking of fluid from capillaries. In anaphylaxis, though, the leakage is so massive that volume depletion and shock may result. Not only that, but the leakage in the lungs may cause wheezing, and leakage in the mucous membranes of the airway may cause airway obstruction from swelling.

Danger signs for progression toward anaphylaxis include:

- syncope (unconsciousness);
- symptomatic hypotension;
- lip swelling;
- hoarseness; or
- wheezing or shortness of breath.

All PA-ASRC/ER-NCRC personnel should see their personal physicians and obtain prescriptions for Epi-Pens®. (Paramedics, nurses, nurse practitioners, physician assistants and physicians may carry injectable epinephrine instead.) This device allows injection of epinephrine without special training. If providers of any level have an Epi-Pen® and are confronted by a patient with the above signs of a severe allergic reaction progressing toward anaphylaxis, they should offer the Epi-Pen to the person and assist the person in using it.

HH. Crush Injury and Myoglobinuria

When a person is trapped under a rock in a cave, or in a building collapse, rescue too often ends with sudden death. Though the person has survived days of entrapment, the sudden release from entrapment allows "evil humors" (various poisonous waste products, including potassium and lactic acid) to escape into the blood. The entrapped limb may also act like a sponge, soaking up precious intravascular fluid, causing sudden shock. This "crush syndrome" is well-recognized, and can be prevented.

The stress of release from entrapment may also contribute to renal failure (kidney failure). Renal failure can occur even if the patient is still producing urine. Renal failure causes death over the course of several days, as waste products build up in the blood.

You can help prevent hyperkalemia, acidosis, shock, and renal failure by preventing dehydration. If a patient is already dehydrated from long entrapment, *rehydration* prior to release is essential. Intravenous fluids are ideal but you won't always have them; give oral fluids if the patient meets the requirements described above (see page 7).

Myoglobinuria: With crush injuries to muscle and other soft tissues, and with severe burns, large amounts of myoglobin are released into the circulation. Myoglobin is an O_2-carrying molecule found in muscles. It is similar to the hemoglobin molecule found in red blood cells. Myoglobin and hemoglobin are toxic to the kidney. (Hemoglobin in red blood cells and myoglobin in muscle cells are necessary, but hemoglobin and myoglobin are toxic when free in the blood. After lightning strikes or severe burns, hemoglobin may be released from thousands of damaged red blood cells. The loose~ hemoglobin can cause problems similar to myoglobin.) When dehydration causes concentration of urine in the kidney, the high levels of myoglobin or hemoglobin in the urine are known as myoglobinuria and hemoglobinuria. Myoglobin is dark brown, and with myoglobinuria, the urine looks very much like tea. Hemoglobin is a bit more red, but still dark.

If you are caring for or transporting a patient, and based on the mechanism of injury you suspect myoglobinuria or hemoglobinuria, check the patient's urine. If it is brown or tea-colored, start treating for possible myoglobinuria, increase oral (or intravenous, if using an IV) fluids as necessary to maintain a urine output of 100 cc/hr (4 cc/kg/hr in children) unless there are definite signs of fluid overload. When giving oral rehydration to a victim of crush syndrome, give fluids with salt but without potassium for the first several liters: drinks salted with table salt are best. After this, you may switch to other types or rehydration fluids. (Crush injury releases much potassium into the blood, and high levels may make the heart stop.)

II. Compartment Syndrome

Compartment syndrome is caused by blunt trauma to a muscle compartment. Muscle

compartments are groups of muscles bounded by walls of tough fibrous tissue. The most common compartment to develop compartment syndrome is in the anterior compartment of the lower leg.

Swelling from trauma causes pressure in the compartment to build up. The pressure finally gets to be more than the pressure inside the veins; the veins collapse, and blood can no longer leave the compartment. This sets up a vicious cycle where increasing pressure holds the veins more tightly closed, causing increased pressure, which holds the veins even more tightly closed, and so forth.

When pressure in the compartment exceeds the pressure in the capillaries, muscle perfusion stops; this will cause severe muscle pain and tenderness over the compartment. The increasing pressure damages sensory nerves traveling through the compartment, so you will find numbness over the compartment and distal to it (e.g., in the web space of big toe for the calf compartment). Finally, arteries traversing the compartment collapse from the pressure. (E.g., the patient may lose the dorsalis pedis pulse.) Diagnose compartment syndrome by looking for the following:

- severe pain, swelling, and tenderness;
- a progression of findings: the patient loses sensation distally, then loses motor strength distally, and finally, loses the distal pulse.

If you think a patient has compartment syndrome, and you face a long evacuation, try to have a surgeon brought in to operate on the leg, or urgent evacuation and transportation to a trauma center.

Other first aid treatments have been suggested for compartment syndrome: elevation and cold. There is little or no evidence that either is effective, and at least some reason to suspect that each might actually be harmful.

JJ. MAST Garment Use

Use the MAST garment only temporarily, i.e., about 1.5 hours, otherwise, it might cause irreversible ischemic damage to legs. (The MAST garment is not designed for use longer than an hour or so.) You may find the MAST garment helpful in patients with only mild dehydration or mild shock when they must be raised vertically (head-up) out of a pit or lowered vertically (head-up) down a vertical cleft. Inflate the MAST prior to raising, and slowly deflate the MAST right after leveling the stretcher again, monitoring the blood pressure carefully. This may help prevent seizures from lack of blood to the brain; it is using the MAST garment as a "G suit" and not for its usual medical purpose, and thus should not be construed as going against standard EMT training for using MAST garments.

KK. Psychological Management

1. Pain Management

Pain, even that from major trauma, has a large *psychological component*. Part of this is perception: the more one concentrates on pain and the consequences of the injury, the more it hurts. Part of this is related to endorphins, narcotic-like chemicals that may be produced in the brain or spinal cord to block pain. These pain control systems are amenable to control in a variety of ways.

Apprehension may accentuate pain, and if the person is worried about the extent and implications of his injuries, a clear statement of the patient's injuries may dispel unwarranted fears and thus reduce apprehension and pain.

Distraction can greatly diminish the perception of pain: you may give an absorbing task to a patient or engage his interest in a discussion.

You may invoke imagination to distance a patient from his pain: ask the patient to imagine his favorite place or event as vividly as possible and describe it to you in detail. Imagery in this way can provide powerful pain relief.

If you have the training and the patient has the ability, an extension of this to a light state of hypnosis may serve as outstanding pain control.

2. Anxiety Management

Many patients are anxious, and rightfully so. Some may even be so anxious as to appear unreasonable, or partially or completely psychotic.

Managing such a patient, or for that matter any patient, includes:

- *Minimizing sensory overload.* A rescue scene looks pretty psychotic, even to sane individuals. To someone with difficulty controlling his or her thinking, the chaos can be literally mind-numbing. You can tell the Field Team Leader that a quiet scene is required for the patient's health and safety (which is true).
- *Channeling patient contact* through one and only one person (you, the medic). This is a good rule for all wilderness patients, but particularly true for those with psychotic features. If you must turn over patient care to another member of the team, always be sure to introduce your relief to the patient, as the patient will often develop a strong trust of you and can feel abandoned if you turn care over to another. Introducing your relief will help eliminate this feeling in your patient.

You must understand that, even though the patient appears confused and may answer inappropriately, *the patient may still have excellent understanding.* Therefore, you must continue to talk as if the patient understands, even though the patient's replies seem nonsensical. Sometimes, the patient's body language is a better answer than the words coming out of the patient's mouth. (E.g., nodding the head "yes" despite saying something bizarre.) Communicating with many psychotic patients can be effective as long as you don't give up easily. And, as with the unconscious patient, you always explain what's happening, even if you aren't sure the patient is hearing or understanding.

Some wilderness patients are experienced *outdoorspeople.* These people are used to being in situations where they are totally responsible for their own survival and well-being. The change to being strapped into a litter and being dependent on a loud, smelly, scraggly-looking search and rescue team, is likely to provoke anxiety if not downright hostility. Doing whatever you can to respect the patient's dignity will do much to assure cooperation. "talking down" to such a patient is a sure way to lose your credibility in the patient's mind.

You will do well to treat such a patient as an equal in intellectual and outdoor terms. For instance, you might explain some details of the search and rescue technique, just as you might teach an experienced outdoorsman who just joined the team. This can be a great confidence-builder for the patient, and can serve as excellent distraction, especially for patients who tend to intellectualize. Intellectualization is a very high level defense mechanism against psychological stress. It might even result, eventually, in a new recruit for the search and rescue team.

Laying on of hands in wilderness search and rescue, or any phase of prehospital emergency medicine, is a touchy subject (pun intended). Palpation is an integral part of the physical exam, as is exposure of the body, and is necessary for the patient's well-being.

Male rescuers worry about homophobia (fear of unwanted homosexual advances by heterosexual men) and female patients' fear of sexual assault (especially with a female being undressed by a group of smelly, unkempt, mostly male rescuers). Female rescuers, too, may worry about their laying on of hands being misinterpreted, whether by male or female patients, but women in American society have less of a tabu about touching others.

In the Emergency Department, patients expect to get undressed and have doctors and nurses poke and prod at various parts of their body, including, for women, pelvic exams, and for men, rectal exams. Doctors and nurses work so much with naked patients and are so used to using their hands in their work that it is no problem for them.

For the rescuer on the side of a mountain or in a cave, however, the social situation is not nearly so easy. The problem, however, is usually more for you than for the patient. Most wilderness patients are so far removed from their normal environment that concerns of the "real" world seem far away. Having one's clothes cut off and a rectal temperature probe inserted seem inconsequential, at least when compared with the prospect of another night in the wilderness. You should keep this in mind, so that any of your own embarrassment does not become obvious to the

patient. However, you should exercise as much discretion as is possible.

Wilderness patients have told, in retrospect, of the most reassuring part of a harrowing rescue: a warm hand on the shoulder. Although, as with everything a rescuer does, common sense and careful observation of the patient is imperative, a good general rule about touching patients is: don't keep your hands off. No one likes to be taken care of by someone who has a "hands off" approach. If the patient finds it objectionable, a person with any powers of observation at all should be able to tell.

3. Psychological First Aid

You may encounter search and rescue team members having immediate stress reactions, and may be the person best qualified to deal with the situation. Rescuers are quite capable of performing on-scene psychotherapeutic "first aid," following the guidelines presented here. A *critical incident* is any situation faced by an emergency services worker that generates unusually strong emotional impact. These include:

- the serious injury or death of an emergency services worker in the line of duty;
- the serious injury or death of a bystander from an emergency services operation;
- multiple deaths or serious injuries;
- serious injury or death of a child or infant;
- any situation that attracts an unusual amount of attention from the media;
- any loss of life after extraordinary and prolonged search and rescue efforts; and,
- any situation that is charged with emotion and that causes an emotional response that is beyond the normal coping mechanisms of emergency services workers.

The *immediate stress reaction* may include physical, emotional, cognitive, and behavioral components. Any of these signs and symptoms may be present. It generally occurs at the time of the incident or within 24 hours. A most important point: *an immediate stress reaction is the response of a normal person to an abnormal situation, and not a sign of any psychological weakness or chronic psychiatric problems.*

Physical symptoms include:

- profound fatigue and weakness;
- fine tremor or muscle twitches;
- diaphoresis;
- vasovagal orthostatic hypotension or vasovagal syncope (simple fainting);
- nonspecific lightheadedness;
- nonspecific headache;
- difficulty focusing one's eyes;
- nonspecific difficulty hearing;
- palpitations;
- dyspnea and chest pain with or without hyperventilation;
- nausea, vomiting, diarrhea, or abdominal pain; or
- sensation of a lump in the throat (globus hystericus).

Emotional symptoms include:

- anticipatory or generalized anxiety (anxiety about the future, or unconnected with any present danger or fear);
- strong fear or even panic reactions;
- psychological shock (described later);
- survivor guilt uncertainty (guilt over surviving when others have died);
- acute grief reactions;
- depression; or
- intensified or inappropriate emotional reactions to normal occurrences.

Cognitive symptoms include:

- blaming others (sometimes even those who are logically blameless) for the critical incident;

- generalized confusion;
- inability to concentrate;
- inability to perform simple calculations;
- poor attention span;
- memory lapses;
- anomia (inability to find the right words);
- inability to distinguish the difference between serious and trivial concerns;
- inability to make decisions; and
- greatly increased (or greatly decreased) alertness and awareness of surroundings.

Behavioral symptoms are relative to the person's normal behavior patterns, which may vary widely between individuals. They include:

- changes in normal activity patterns;
- changes in speech patterns;
- withdrawal;
- angry outbursts;
- hypervigilance (increased suspicion and attention to one's environment or even outright paranoid behavior;
- changes in interactions with others (i.e., wife, friends, team members);
- increase or decrease in appetite~ or alcohol consumption;
- sleep disturbances, including early morning awakening, early insomnia, hypersomnia, and generalized fatigue; or
- visits to health professionals (possibly including the team medic) for seemingly minor or even nonexistent problems.

Look for those who are showing some signs of stress (even if not a full-blown immediate stress reaction) and try to arrange rest breaks for them. Look for those with immediate stress reactions: a person walking about aimlessly, a person sitting and staring blankly (unless simply exhausted), or a person behaving irrationally.

The first step in managing an immediate stress reaction is to isolate the person from the sights, sounds, and smells of the incident. Having the person face away from the incident, or get on the other side of a vehicle, may be effective. If smells are prominent, move the person upwind. If you determine that the person should not be moved, place an object to block the person's view.

When engaged in on-scene psychological first aid, peers (e.g., other rescuers) can ask "Hey, are you OK?" However, this is *not* an acceptable question coming from a mental health worker at the scene. For this kind of psychological first aid, you just need to lend a sympathetic ear. If you need to prompt the person to start talking, start asking about facts first, and only after some rapport is established, start asking about feelings.

When an emergency services worker "breaks down" in the course of psychological first aid, it is important to *validate* the person's feelings ("hey, this is pretty hard for *all* of us to take.") and *back off*, going to another person or another topic. Do not abandon the person; monitor him or her, and arrange extra help if it seems necessary.

Group interventions are *never* appropriate at a scene where hazards are still a problem. All on-scene psychological first aid should be one-on-one.

♦