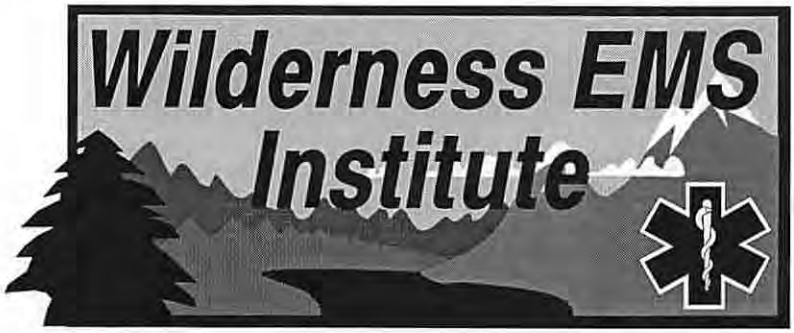

Appalachian Search and Rescue Conference
Center for Emergency Medicine of Western Pennsylvania

Wilderness EMT Lesson Plan

Part XVIII: Principles of General Medicine

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Comments to:
Roy Alson, Ph.D., M.D. Task Group XVIII Leader
162 Hunter's Ridge Road Winston-Salem, NC 27103
(919) 768-3105 (H) (919) 748-2193 (W)

Task Group: Sherwood Chetlin, M.D.; Keith Conover, M.D.; Eric Davis, M.D.; William W. Forgey, M.D.; Lorick Fox, Jr.; Stephen A. Gates, M.D.; Murray Gordon, M.D.; Fred Harchelroad, Jr., M.D.; John R. Kihl, R.N.; Michael S. Kuga, EMT; Robert Lasek, M.D.; William Mackreth, EMT-P; Jeffrey Mitchell, Ph.D.; Charles Stewart, M.D.; David Thomson, M.D.; Ray Townsend, M.D.; Ricardo Townsend, M.D.; and James A. Wilkerson, M.D.

Project Coordinator:
Keith Conover, M.D. 36 Robinhood Road
Pittsburgh, PA 15220-3014 412-561-3413

Verbose Outlines

We develop our WEMT Lesson Plans in a **verbose outline format** (what you see here). Why? Because the material is new to enough reviewers that the usual terse ("telegraphic") lesson plan format might be incomprehensible or misleading.

Our Task Groups use these "verbose" outlines. Each part of the WEMT curriculum (about twenty in all) has a Task Group of five to twenty selected consultants. A Coordinator guides the Task Group in revising the section.

Each Task Group provides references to support its statements and for further reading. They also provide glossary entries for any new terms they introduce. (New, that is, to a reader with basic EMT and SAR training.)

Background material that should appear in the Textbook (see below), but instructors need not present in class, will appear *in a small, italic font.*

Splitting the Outlines

When the outline satisfies the Task Group, it goes to our **Editorial Board**. This Board includes officers of the Appalachian Search and Rescue Conference and Center for Emergency Medicine of Western Pennsylvania, our two sponsors. It also includes experts in emergency medicine, search and rescue, and education. The Editorial Board reviews the verbose outline, and requests any necessary revisions. Once it is acceptable to the Board, we reformat the outline, into two distinct new versions.

We rewrite the material in the standard lesson plan format, which becomes a terse "telegraphic" outline. This version will be briefly reviewed by the Project Coordinator and then released to the public. It is the result of extensive review and testing, and will be used in all our classes. But, we still publish it as a draft, because we expect many good suggestions from the public. We distribute these drafts as widely as possible. After each year of public review, the Task Groups reviews comments, and submits revisions to the Editorial Board. Once all outlines have withstood a year of public scrutiny, we will prepare a single comprehensive curriculum with a Course Guide. We will continue to review and revise the curriculum regularly.

On to a Textbook

As explained above, once the Editorial Board approves the verbose outline, we split it into two versions. Besides the terse teaching outline, it will also become the basis for a textbook chapter. The Project Coordinator is the textbook Editor-in-Chief, and works closely with the Task Groups to consolidate and revise the verbose outlines into a comprehensive textbook. All who have contributed to the curriculum will be acknowledged as contributors. The textbook will be commercially published when completed. Until the textbook is available, we will distribute the verbose outlines or drafts of the textbook at classes.

Notes: *Principles of General Medicine*

Part of the problem of training WEMTs is that we must train the WEMT to deal with situations that we have not imagined, often when they have no communication with a medical command physician. Therefore, we have elected to teach the WEMT the most basic principles of medicine and nursing in this section. While the psychological aspects of the section are of benefit in all patient care, the principles of infectious diseases, wound care, and convalescence are of less direct applicability for the WEMT. Nonetheless, we felt the course incomplete without this basic information.

This section must be taught by a physician, Physician's Assistant or Nurse Practitioner. EMT-Ps, even those who have completed a course based on this curriculum, do not have the depth of training and experience to teach this section.

XVIII. Principles of General Medicine

A. Educational Objectives

1. Briefly define the following terms, and give an example of a disease caused by each:
   a. parasites;
   b. bacteria;
   c. aerobic bacteria;
   d. anaerobic bacteria;
   e. gram negative bacteria;
   f. gram positive bacteria;
   g. viruses;
   h. Rickettsiae; and
   i. fungi.
2. Define the following:
   a. "normal flora";
   b. white blood cells;
   c. vector;
   d. "the Four F's": Flies, Fecal contamination, Food, and Fomites;
   e. antibiotics;
   f. immunizations.
3. Identify four factors that make a wound likely to become infected.
4. Identify major potential sources of bacterial contamination of wounds that a WEMT will care for.
5. Briefly explain the appropriate use of antiseptics in wound care.
6. Define atelectasis, and describe means to prevent it in an immobilized patient.
7. Identify three major criteria for giving oral fluids to a wilderness patient.
8. Identify four factors that increase daily fluid needs over baseline.
9. Identify the usefulness and limitations of providing food calories by adding ampules of dextrose solution to the IV bags of wilderness patients.
10. Define decubiti and describe means to prevent their development in litter patients.
11. Describe how pain influences and is influenced by the psychological state of an individual.
12. Identify methods for dealing with a wilderness patient's pain without medications.
13. Identify three signs of psychotic reasoning, and identify three important principles in dealing with a patient with psychotic reasoning.
14. Explain the use of intellectualization as a psychological defense by experienced outdoors enthusiasts who are injured, and how a Wilderness EMT can use this to improve interactions with such a patient.
15. Describe the role of physical conditioning in preventing illness and injury.

B. Asepsis and Prevention of Disease Spread

1. **Germs and Disease:** Fringe holistic claims to the contrary, "germs" (invisible living agents) are at the root of many diseases. Though some only attack humans whose defenses have been breached in some manner, others are adept enough to penetrate our best defenses. Many types of infectious agents may cause human disease:
   a. Small, **unicellular parasites** like *Giardia lamblia* or *Entamoeba histolytica* are causes of diarrhea in wilderness hikers. Parasites are organisms that live at the expense of another organism, usually inside or on the victim. As distinguished from sym-

biotes and commensals, organisms that live together without a one-way arrangement.

b. Larger, **multicellular parasites**, such as various tapeworms, are important causes of disease in many tropical or subtropical areas.

c. **Bacteria** are small single-celled organisms also called prokaryotes. They are distinguished from the cells of more complex organisms (eukaryotes) by, among other things, their small size and lack of a nucleus. Some **bacteria** cause infection:

(1) **Aerobic bacteria** (ones that need oxygen to live) such as *Staphylococcus* and *Streptococcus*, are normal skin, nose and throat flora, but some particularly virulent strains may cause skin infections (e.g. boils or cellulitis); even the normal nonvirulent skin species may cause an infection if conditions are right. Staph and strep are called "**Gram positive**" bacteria because of how they appear under the microscope with the Gram staining method.

(2) **Gram negative** aerobic bacteria may cause ear infections or urinary tract infections; the distinction between gram positive and gram negative is not academic, as some antibiotics are better against Gram positive than negative or vice versa.

(3) **Anaerobic bacteria** are found in the mouth, in the intestine, and in soil. *Clostridium tetani*, a normally innocuous anaerobic soil bacterium, will cause tetanus when it grows in puncture wounds or wounds that have been repaired (creating an anaerobic environment). Although the infection will not look impressive, the bacteria secrete a waste product that causes muscle spasm, respiratory paralysis, and rapid death. (Immunity to this poison is provided by tetanus toxoid immunization shots.)

d. **Viruses** are small semi-alive "germs" that can cause disease. Viruses cannot live by themselves, but are parasites that require a cell of some other organism to reproduce. Viruses generally consist of DNA surrounded by a protein coat, but little else. They are much smaller than even the smallest bacterial cells. Viruses are the cause of many diseases, including the *Rotaviridae* that cause many types of gastroenteritis, the *Rhinoviridae* that cause the common cold, and the dread Rabies virus. Viruses can only reproduce inside the cells of their host.

e. Some diseases are caused by unusual organisms, between viruses and bacteria in size, such as the *Rickettsiae* that cause Rocky Mountain Spotted Fever and that are found in the mouth of certain ticks, and are susceptible to the antibiotic tetracycline. The *Mycoplasmas* are similar to the *Rickettsiae*, and are a common cause of pneumonia; erythromycin is commonly used to treat Mycoplasma pneumonia.

f. **Fungi** include yeasts, molds, mildew, toadstools, and mushrooms. Some fungi may cause infections.

(1) For example, the group of fungi known as "tinea" cause athlete's foot (tinea pedis), ringworm (tinea corporis), and jock itch (tinea cruris). Some forms of yeast cause yeast vaginitis and oral thrush. These problems are usually more irritating than dangerous, but can lead to secondary bacterial infections that are more serious.

(2) Fungi rarely cause severe disease except in those with immune deficiency. An exception is **histoplasmosis**, which is a fungal lung disease. You catch histoplasmosis from breathing in the spores, which are found in areas where the soil is contaminated by fecal material from chickens, starlings, or bats. His-

toplasmosis is particularly common in the Ohio and Mississippi river valleys extending east to Virginia and Maryland, and is found in caves in many parts of the world. Infection with histoplasmosis causes cough, fever, and malaise. Most people recover in a week or two with no need for treatment. For those who are severely ill, some intravenous antifungal antimicrobials are available, but have serious side effects.

2. **Defenses** against infection include:

   a. intact skin and mucous membranes,

   b. "normal flora" bacteria found on skin, on mucous membranes, and in gut, all tend to prevent growth of "bad" bacteria; and

   c. white blood cells of various kinds, which analyze threats and

   (1) program some white blood cells to directly attack bad germs, or

   (2) program other white blood cells to secrete protein antibodies that specifically attach to bad germs, so that

   (a) some white blood cells will attack the marked germs, and

   (b) chemicals in the blood also attack the germs.

   d. The effectiveness of this complicated immune system is affected by state of nutrition, physical and emotional stress, and fatigue.

3. **Vectors:** Many infectious disease agents are introduced via a "**vector**": e.g., the bacterium that causes Lyme disease and the *Rickettsia* that causes Rocky Mountain Spotted are transmitted by the bite of a tick, the parasite that causes malaria is transmitted by the bite of a mosquito, and the rabies virus is transmitted by the bite of a rabid animal. Keeping the vector away means keeping the disease away.

4. **Person-to-person transmission:** Many infectious diseases are transmitted from person to person.

   a. Two common contagious illnesses in the wilderness are diarrhea and colds. Diarrhea may come from contaminated water, but proper treatment of all drinking water with iodine water-purification tablets or other iodine methods, or bringing to a boil, should eliminate almost all causes. (Water treatment is discussed further in the section on *The Wilderness Environment.*) It is also possible to contract diarrhea from another person, but proper hand washing and care to avoid contaminating food with dirty hands will minimize this. Colds might rarely be transmitted by drinking from a common water bottle, but the most common way to catch a cold is from rubbing eyes or nose-picking with contaminated hands. (No, this isn't a joke, it's straight lectures given by the National Institutes of Health!)

   b. According to World Health Organization propaganda aimed at Third World countries, many diseases are transmitted by the "**four F's**": **Flies, Fecal contamination, Food** that has become contaminated, and **Fomites** (those little droplets that come out when you sneeze). The same holds true for wilderness problems such as infectious diarrhea, which can decimate a wilderness search and rescue team. Prevention? Wash hands regularly, especially the nails, and especially after a trip into the woods, and before eating or working with food.

5. **Medical Countermeasures:** There are two main types of medical countermeasure against infectious disease:

   a. **Antibiotics** are drugs which poison bacteria or other infectious agents, yet are non-poisonous or only slightly poisonous to humans. Unfortunately, for

many diseases, including most viral infections, no antibiotic is available.*

b. For certain diseases, including many viral infections, a second type of countermeasure may be employed: **immunization**, also known as vaccination. If you are injected with a dose of killed or weakened virus or bacterium, or one of their poisons, you don't become ill (other than a slight fever), but your body develops antibodies and other immunity against the virus, bacterium, or poison: you are then immunized against it. Most children are now routinely immunized against Diphtheria, Pertussis (Whooping Cough) and Tetanus (the "DPT" series), Measles, Mumps and Rubella (the "MMR" series) and Polio. Generally, everyone should get a booster dose of tetanus toxoid every 10 years, or sooner with a grossly contaminated wound. Immunizations for other diseases are available but not routine. All SAR team members should keep their tetanus immunization up to date. Though the rule for the general public is a booster every 10 years, we recommend that wilderness travelers get one every five years.

c. The kind of immunization described above is the most common and is termed "active immunization." It is active because your body actively produces antibodies against the germ or poison. "Passive immunization," on the other hand, is simply giving an injection of someone else's antibodies. Gamma globulin shots are sometimes given to those going to an area with lots of Hepatitis A. Gamma globulin is a purified preparation of antibodies, and thus this is a form of passive immunization. Passive immunization does not last as long as active immunization.

6. **Wound infections**

a. Wound infections are of particular interest to the WEMT. Some wilderness patients are found with infected wounds. Others have wounds, and you, as a WEMT, will be caring for the patient's wound long enough to share in the blame should the wound become infected.

b. The likelihood that a wound will become infected depends on:

(1) the virulence (strength) of the particular strain of bacteria,

(2) the number of bacteria introduced; and

(3) the resistance of the tissue against infection. Resistance to infection depends on:

(a) the blood supply. Wounds on the shin are notorious for infection because of poor blood supply, whereas face and scalp wounds rarely become infected, because of the copious blood supply.

(b) foreign material in the wound. Foreign material, especially clay-containing soil or vegetable matter, makes it much more likely to become infected.**

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* Strictly speaking, antibiotics are only those anti-microbial drugs that are made by bacteria. Many of today's "antibiotics" are made in a laboratory, and are thus "antimicrobials" but not truly antibiotics. However, because of the common usage of the term antibiotic for all antimicrobials, we'll henceforth use "antibiotic" to refer to any antimicrobial.

** Certain materials are relatively inert in wounds, such as clean pieces of glass or metal, or the monofilament nylon sutures often used to close wounds. Wood and braided fibers have many microscopic nooks and crannies for bacteria to hide in, and are known to cause wound infections. Grease and staining from materials such as pencil "lead" (actually graphite) are

(c) the state of the tissue in general. Ischemic, bruised, or swollen tissue is less resistant to infection.

(d) the state of the person in general. Dehydrated, starving, or traumatized people have decreased resistance to infection for many reasons.

c. Pathogenic bacteria are introduced into wounds:

(1) in soil, saliva, or other contaminants, at the time of injury;

(2) by migration of nearby skin bacteria (there are large numbers of bacteria on the skin, particularly under the nails, around the mouth, on the scalp, and in the groin);

(3) by someone speaking, sneezing, or coughing near wound (our mouths have the highest bacteria count of anywhere in the body);

(4) from the skin (particularly under the fingernails) of those caring for the wound, either initially, or when changing dressings; or

(5) by contamination from other sources, i.e., when dressings become wet, or become contaminated with urine or fecal material.

d. The main goal in caring for a wound is not simply to avoid infection, but to have it heal with function and appearance preserved as nearly as possible; that is why we repair (suture or staple) wounds. Repairing a wound, however, can cause problems if one seals in an infections; drainage of pus (dead tissue, dead white cells, and bacteria) is an important defense mechanism.

e. Many "antiseptics," while they are good at killing bacteria and other pathogens, and while they are safe on intact skin, such as around a wound, are toxic to tissue in open wounds. Never put antiseptics in a wound unless the wound is grossly contaminated. Clean (not even necessarily sterile) water or saline, under pressure, is the approved way to clean bacteria from wounds prior to repair. (Even if repair is just approximating the wound edges with tape.)*

f. Principles for preventing wound infections, both when cleaning and repairing, and for afterward, are as follows.

(1) Don't talk to wounds. They don't answer, but they will get infected. Wearing a mask isn't absolutely necessary, so long as you keep you mouth closed when pointing at the wound, and don't sneeze at it.

(2) Don't let your fingernail bacteria into the wound. Either scrub nails thoroughly with regular soap (or surgical scrub soap if available), or wear gloves.

(3) Don't allow dressings to become wet; bacteria crawl much more quickly through wet dressings. (Wet dressings are sometimes used for certain conditions, but with care to avoid bacterial contamination.)

(4) For most healing wounds, clean once or twice daily with warm water to remove crust that serves as breeding grounds for bacteria (this is particularly true for wounds that have been repaired). Then, apply a mild antibiotic ointment (e.g., Bacitracin ointment).

(5) You may use antiseptics such as povidone-iodine (Betadine®) around a

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harmless, but red clay such as found in Virginia, West Virginia, and North Caroline is particularly productive of wound infections, because the bacteria can hide on the clay particles, but they are big enough that white blood cells cannot engulf them.

* More about wounds is found in the section on *Wilderness Surgical Problems.*

wound, but don't use antiseptics in wounds.*[1,2]

C. Nutrition, Convalescence, and Recuperation

1. **The Response to Injury**

a. The body has predictable responses to severe illness or injury. During this response, the body has increased needs for nutrition (satisfied, initially, from body reserves) and has increased susceptibility to environmental stresses. The extent and severity of the response depends on type and severity of injury.

b. **Acute injury phase:** There is a release of catecholamines like adrenaline, a shift of fluid to the area of injury (swelling helps splint injuries), inflammation in injured area (inflammation brings blood to fight infection, and to remove dead tissue), and decreased appetite (to use stored energy rather than using up precious energy and fluid for digestion). This lasts for about 2-5 days. Treatment goals during this period include the following.

(1) **Replace fluids:** the patient may have increased needs.

(2) **Control pain.**

(3) Take steps to **minimize extension of injury** or illness (treat with antibiotics, clean wounds, treat frostbite with aspirin and ibuprofen, etc.)

(4) **Prevent atelectasis** (collapse of small segments of lung) and pneumonia with suction (if needed), postural drainage and chest PT (pounding moderately on the chest with the patient in a slightly head-down position with the affected lung uppermost), and by encouraging deep breathing and coughing (the patient may need pain medication for this to be effective).

(5) **Provide some energy** through dextrose in IV solutions, if used; small amounts of sugar may be given orally if there is no contraindication.

c. **Turning point:** The turning point is the transition between the acute injury and anabolic phases. It generally occurs from 5-6 days after injury.

d. **Anabolic phase:** The anabolic phase is when damage control has been completed, and rebuilding has started. The patient has increasing appetite and activity. Treatment goals during this point include the following:

(1) provide **easily digestible food**; and

(2) allow gradual **increase in activity**.

e. **Fat gain phase:** During the fat gain phase, the patient starts restoring energy reserves.

2. **Fluids and nutrition**

a. Patients can use the oral route for medication, food, and water, but only under certain conditions.

b. First, the GI system must be working. If the patient has an ileus, nothing you give by mouth will be absorbed. What is worse, it will sit in the patient's stomach until the patient vomits it back up. At the best this is unpleasant for everyone, and at the worst, the patient aspirates and dies. The concept of "ileus" is discussed further in the section on *Burns and Lightning*. In brief, to be sure that the GI system is working properly, check for normal bowel sounds and ask the patient if he or she is passing flatus per rectum.** Also, ask the patient — someone who is nause-

* Exceptions are discussed in the *Wilderness Surgical Problems* section.

** Farting.

ated is not likely to keep down fluids you give.

c. Second, the patient must be alert enough able to eat or drink without aspirating. People often say "the patient must have an intact gag reflex." But, about 30% of normals don't gag, ever, and these people don't spend their life aspirating everything they eat or drink. We just want someone alert enough to have an intact swallowing mechanism.*

d. Third, don't give oral fluids to someone who is probably going to go to the operating room in the next 6-8 hours. This would include open or severe fractures, abdominal injuries, or severe abdominal pain. Why? Because of the possibility of aspiration as the patient is being put under anaesthesia. If you're more than 6-8 hours from the operating room, however, you may be able to give fluids up until about 6 hours before the patient is likely to reach the hospital.

e. If you're going to start your patient on oral fluids, start with small sips of clear fluids. Don't let the patient take large amounts, no matter how thirsty. If the small sips stay down, then gradually give larger amounts.

f. **Fluids**

(1) The normal minimal need is about 2 liters/day for a standard-sized adult. Pediatric fluid requirements vary with weight. You can use the following formula to calculate minimal fluid needs based on weight. For the first 10 kilos, add 100cc per kilo per day; for each of the next 1-kilos, add 50cc per kilo per day; and for every kilo above 20, add 20 cc per kilo per day.**

(a) 0-10kg100cc/kg/day

(b) 10-20kg+50cc/kg/day

(c) 20+kg+20cc/kg/day

(2) Fluid needs are significantly increased by:

(a) fever (which increases insensible perspiration);

(b) bleeding;

(c) vomiting or diarrhea;

(d) swelling in injured areas (including "third space" losses in abdomen that may not be visibly obvious); and

(e) increased loss through damaged skin (large abrasions or burns).

(3) The best way to know that fluid replacement is adequate is to see a urine output of 50cc/hr or better. (Pediatric patients: 1cc/kg/hr.) Even if a Foley catheter or Texas catheter is not used, you can carefully measure the patient's urine output by having the patient urinate in a bottle and measuring the urine prior to discarding it. If you then average over a period of several hours, you should have an accurate assessment.

g. **Electrolytes:** we need a small amount of sodium and potassium each day. One liter of Ringer's Solution or Ringer's Lactate provides more than enough for basal needs, and just about any diet has enough to meet basal needs. As long as the amounts given aren't excessive, and the kidneys work

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* It's theoretically possible for someone to have a stroke that damages the swallowing mechanism and leaves a patient alert, but the chances of your rescuing such a patient in the wilderness is negligible.

** Thus, for a 40 kilo child, this would be: 100cc/kg/day x 10 kilos = 1000cc/day, plus 50cc/kg/day x 10 kilos = 500cc/day, plus 20cc/kg/day x 20 kilos = 400cc/day, for a total of 1900cc/day.

properly, extra will be excreted. High or low values of sodium or potassium can cause heart and CNS problems, but cannot be diagnosed in the field.* Electrolyte losses are increased with:

(1) sweating, which causes loss of both sodium and potassium (e.g., with varying fever, or a hot environment);

(2) vomiting and diarrhea, which cause loss of significant amounts of both sodium and potassium; and

(3) burns, bleeding, or third space losses which decrease the available electrolytes.

3. **Caloric (energy) needs**

(1) A normal adult on garrison duty needs 1700-2000 Kcal (Calories with a big C) each day.**

(2) This is increased markedly by strenuous exercise or injury up to about 4000 Calories a day. Also, fever increases basal metabolic rate about 10% per degree, and energy needs increase correspondingly.

(3) Most people have energy stores enough to last for days to weeks, even if injured.

(4) You cannot give enough through an IV in the field to make a significant difference (a liter of D5W (5% dextrose solution) has 200 Calories, and adding two amps of D50 (50% dextrose solution) to the liter of D5W only brings it up to 400 Calories, only a tenth of the injured patient's needs). However, you should provide what little you can this way. Adding two amps of D50 to every other bag of IV fluid should be a standard treatment for long evacuations with an injured patient.

(5) If you are trying to feed a patient with severe injury or illness, and the patient can tolerate PO (oral) fluids (see above), start with clear fluids with salt and sugar (e.g., Gatorade™ diluted half-and-half with water) because this will be absorbed with minimal energy expenditure. Gradually move to liquids (soups) then to solid food. You can use commercial liquid feedings such as Ensure®, which are available at drug stores, and often carried by cavers and alpine expeditions. Keep the amount of fat minimal to start, to avoid difficulty with digestion. See also about starvation and refeeding in the section on *Scene Management, Communications, Reporting, and Documentation.*

4. **Protein needs**

(1) The body needs a half-gram of protein a day, and more with injury or healing.

(2) You can't give protein through IV in field, but by giving small amounts of glucose in IV (as described above), you can spare the use of some of the body's own protein. When starving, the body breaks down protein into sugar. (The brain, unlike rest of body, can't use fat; so, when necessary, the body will always break protein down to make glucose for the brain.)[3,4]

5. **Pressure Necrosis and Decubiti**

a. Anyone who has been on a backboard for any length of time knows how uncomfortable it can be. Being on an unpadded backboard for a long evacuation can be more than just exquisitely painful; it can be damaging. That's one of the reasons we recommend using a full length vacuum splint instead of a backboard: it distributes

* Except possibly some potassium imbalances by seeing certain changes on an EKG.

** Calories with a big "C"; see the section on *Thermal Regulation* for more on Calories and calories.

pressure much more evenly than a backboard. If you must use a backboard, pad it almost to excess.

b. You know that ischemia causes necrosis. Different tissues can withstand different lengths of ischemia; for instance, the normothermic brain can only tolerate 4-6 minutes without necrosis. Skin is much better at tolerating ischemia; still, it will die if it stays ischemic for hours.

c. Skin that is pressed between a bone and a backboard (or even the bottom of a Stokes litter) is ischemic. When your rear end is on a seat, or your back is lying on an Ensolite™ pad, some parts of your skin are ischemic. Your protection against this is movement. Even in sleep, you move around from time to time. This allows the ischemic areas enough blood flow that they don't die.

d. But what if you can't move around? What if you are deeply unconscious? What if you are tied into a Stokes and can't move?

e. Standard nursing management of an unconscious patient involves regular repositioning. The patient is turned on the left side for a while, then turned on the right side for a while. This continues as long as the patient is unconscious. This is difficult to do if the patient is tied into a litter. However, you **can** turn the litter partly to one side or the other during breaks in the evacuation. For very long evacuations, you might even rig up slings so you can carry the litter for an hour on one side and then for an hour on the other side.

f. If, despite your best efforts, the patient's backside stays ischemic long enough, or if the patient has been laying unconscious in a single position long enough, the patient will develop decubiti (bedsores). There's not much you can do for decubiti during a wilderness rescue except to keep trying to reposition the patient.

g. Wet skin is more likely to develop pressure necrosis and decubiti than dry skin. Skin that is covered with fecal bacteria is more likely to become infected than clean skin. As you probably suspect, this is leading up to the idea that you need to keep your patient's bottom clean. Using a Foley catheter will help keep the patient dry. Use an absorbent pad as a sort of diaper, and change it when the opportunity presents.

D.Pain Control

1. Pain is useful. It lets you know you're still alive, directs your attention to the problem, and encourages you to rest the affected part. Generalized pain makes you limit your activity and conserve scarce energy resources.

2. However, in some wilderness situations, your survival is better served doing what your intellect says, rather than what the pain says. For example, running on a painful ankle makes sense when one is in the path of an avalanche; similarly, walking on a broken ankle makes sense if it's the only way to get out of a wilderness area alive.

3. Pain is a signal which should direct you to a particular organ or disease, which should then be properly treated. If, however, you have treated the primary problem and the pain remains, or if the primary problem is self-limited, such as a simple headache, then there are two main ways you can try to alleviate the pain:

   a. **Medications** may be used to control pain.

   (1) Aspirin (acetylsalicylic acid) and Tylenol® (acetaminophen) are mild over-the-counter (OTC) analgesics that will relieve minor pains, but will

not control severe pain even with toxic doses.

(2) For severe pain, a narcotic is needed. Narcotic pain relievers may be habituating or even addicting, though during a wilderness emergency the risk is slim.*

b. 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.

(1) 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.

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

(3) Physical distraction works, too (at a spinal, rather than brain, level). When giving an IM injection or starting an IV, firm pressure on the nearby skin will diminish the pain from the stick.

(4) 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.

(5) 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.

(6) Remember also that some of these mechanisms may already be at work, so an injury may not be noticed until well after the shock of the accident has worn off. Also, a phenomenon right after psychological stress or trauma known as the **autonomic stress reaction** can mask pain for a few minutes to half an hour or so. A quick general physical exam is always appropriate, even after minor trauma, to seek out such injuries.

E. Psychology of the Wilderness Patient

1. Some victims of wilderness emergencies are inexperienced (which may be why they had the problem in the first place). Such patients tend to develop severe disorientation when lost or injured in the wilderness, and may even appear psychotic. Symptoms of psychotic reasoning include:

a. **looseness of associations** (jumping from one thought to another, seemingly at random);

b. **pressure of speech** (words tumbling over one another in their hurry to get out);

c. **delusions** (misinterpreting things: for example, calling a Stokes litter a coffin, or believing that a search dog is a horse); or

d. **hallucinations** (seeing things that aren't there, hearing things that others don't).

2. **A temporary psychotic state** in the wilderness patient does not necessarily imply that the person will be psychotic back in the "real" world, or even that

* Pain medications are discussed in much more detail in the section on *Pharmacology*.

the person will be psychotic for more than a few minute or hours. Managing such a patient includes:

a. **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).

b. **Channeling patient contact** through one and only one person (you, the WEMT). 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.

c. 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.

3. Some wilderness patients are **experienced outdoorspeople.**

a. 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.

b. 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.

4. **"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.

a. Male WEMTs 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 WEMTs). Female WEMTs, too, may worry about their laying on of hands being misinterpreted, whether by male or female patients, but women in American so-

ciety have less of a tabu about touching others.

b. 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.

c. For the WEMT on the side of a mountain, 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 WEMT 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 WEMT with any powers of observation at all should be able to tell.

5. Many of the concepts covered in the section on *Stress Management and Critical Incident Stress Debriefing* apply to patients as well as rescuers, including management of anxiety.

F. Conditioning

1. (reserved)

Glossary

Aerobic Bacteria: Bacteria that need oxygen to live.

Aerobic: Needing oxygen to live.

Anaerobic: Living by preference, or by necessity, without oxygen (usually applied to species of bacteria).

Atelectasis: Collapse of small segments of lung.

Bacteria: Small single-celled organisms also called prokaryotes. They are distinguished from the cells of more complex organisms (eukaryotes) by, among other things, their small size and lack of a nucleus.

Bedsores: Decubiti.

Catecholamines: Hormones such as epinephrine and norepinephrine.

Decubiti: Bedsores. Skin breakdown and ulceration caused by pressure. A form of pressure necrosis.

Delusions: Misinterpreting things or people.

Endorphins: Narcotic-like chemicals that may be produced in the brain or spinal cord to block pain.

Eukaryotes: Cells that are larger and more complex than prokaryotes (bacteria). Plants and animals are all made up of eukaryotic cells.

Flora: Plants; as used in "flora and fauna" to mean plants and animals. In regards to humans, it refers to the normal population of bacteria found on the skin, in the mouth, in the GI tract, and elsewhere. In some ways, we are dependent on this "normal flora" for our well-being. Cows would starve without their GI bacteria that break down cellulose into a digestible form.

Fomites: Tiny droplets filled with bacteria that come out when you sneeze or cough.

Fungi: A group of organisms including molds, mildew, toadstools, and mushrooms, distinguished by several features from animals and plants.

Germs: Invisible living agents of disease, including bacteria, viruses, and fungi.

Gram Staining: A method of staining bacteria using iodine and other stains. Bacteria that stain deep purple are called "Gram positive," and those that remain light pink are called "Gram negative." For example, Staph and Strep are Gram positive, whereas *E. coli* is gram negative. Gram positive and negative bacteria are also very different in many other ways, for example, their susceptibility to various antibiotics.

Hallucinations: Seeing things that aren't there, hearing things that others don't.

Mycoplasma: A small single-celled parasite that is known to cause upper respiratory infections and pneumonia.

Parasites: Organisms that live at the expense of another organism, usually inside or on the victim. As distinguished from symbiotes and commensals, organisms that live together without a one-way arrangement.

Pathogenic: Causing disease.

Prokaryotes: Bacteria.

Psychotic: A person who is psychotic has only loose connections with reality. He or she may see or hear things that aren't there, and not see or hear things that you can see and hear.

Rickettsiae: A group of small intracellular parasites including the organisms that cause Typhus and Rocky Mountain Spotted Fever.

Thrush: A yeast infection of the mouth, common in children. Thrush is characterized by irritation and redness of the mucous membranes and white "stuck-on" appearing patches.

Tinea: A superficial skin infection with a variety of fungus, including jock itch, ringworm, and athlete's foot.

Vector: An insect or other carrier of disease to another species.

Virulence: The more virulent a type of bacteria is, the fewer are the bacteria needed to create a self-sustaining infection.

Viruses: Small semi-alive "germs" that can cause disease. Viruses cannot live by themselves, but are parasites that require a cell of some other organism to reproduce. Viruses generally consist of DNA surrounded by a protein coat, but little else. They are much smaller than even the smallest bacterial cells.

References

1. Berkow R, ed. *The Merck manual of diagnosis and therapy.* Fourteenth Edition. Rahway, NJ: Merck & Co., Inc, 1982.
2. Wilkerson JA. *Medicine for mountaineering.* 3d ed. Seattle: The Mountaineers, 1985.
3. Moore FD. Homeostasis: Bodily changes in trauma and surgery. In: Sabiston DC, ed. *Davis-Christopher textbook of surgery* Phildelphia: W. B. Saunders, 1981:23-57.
4. Shires GT, Canizaro PC. Fluid and electrolyte management of the surgical patient. In: Sabiston DC, ed. *Davis-Christopher textbook of surgery* Phildelphia: W. B. Saunders, 1981:91-114.