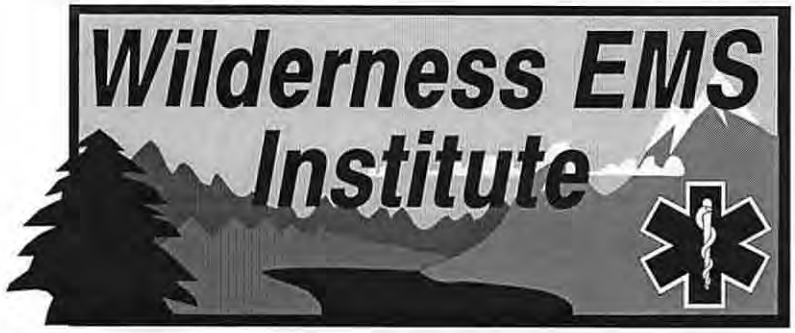
## Chapter XIV:

# Pharmacology




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

# Wilderness EMT Textbook

## Chapter XIV: Pharmacology

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## The ASRC-CEM Wilderness Emergency Medical Services Institute

The ASRC-CEM *Wilderness Emergency Medical Services Institute*, previously named the *Wilderness Emergency Medicine Curriculum Development Project*, is devoted to developing curricula for wilderness EMS providers and medical control physicians, and fosters wilderness EMS research. It is a cooperative venture of the Appalachian Search and Rescue Conference and the Center for Emergency Medicine of Western Pennsylvania. The ASRC is a large, tightly-knit wilderness search and rescue organization with eight teams throughout the mid-Appalachian states. The Center for Emergency Medicine is an emergency medicine and prehospital care research and teaching organization. It provides a medical helicopter service, an emergency medicine residency, Emergency Medical Services for the city of Pittsburgh, and conducts a variety of related projects.

## The WEMSI Wilderness EMT Curriculum

This chapter is one part of the ASRC-CEM Wilderness Emergency Medical Technician Textbook. In concert with the WEMT Curriculum, the Textbook has been in development since 1986, and took as its starting point a program Dr. Conover developed for the National Association for Search and Rescue in 1980. The Project has also drawn on many other sources in creating this Textbook. These include the Wilderness EMT program of SOLO (Stonehearth Open Learning Opportunities), the WEMT program developed by Wilderness Medical Associates, and the Winter Emergency Care Course of the National Ski Patrol. The Wilderness Medical Society's educational and research publications provide needed background for the Textbook. The National Association of EMS Physicians has developed and has published clinical guidelines for delayed/prolonged transport; WEMSI protocols are also available as a model.

With textbooks used by its EMT and SAR prerequisites, this Textbook provides all the training material needed to complete the Wilderness Prehospital Emergency Care curriculum established by the Wilderness Medical Society. (Indeed, early drafts of this textbook were a major resource for the WMS curriculum.) We assume that students have the knowledge and skills of an EMT-Basic or EMT-Paramedic. (The curriculum can accommodate both EMTs and paramedics in the same class.) We also assume that students have the knowledge and skills of the Virginia Ground Search and Rescue Field Team Member standards or better. (EMT standards are available from state EMS offices or the U.S. Department of Transportation. The Virginia GSAR standards and GSAR Manual are available from the Virginia Department of Emergency Services, 310 Turner Road, Richmond, VA 23225-6491.) The curriculum is competency-based rather than hours-based, but can be competed in roughly five intensive days. The curriculum also recommends clinical training, for which guidelines are available in the Curriculum.

## WEMT Textbook Chapter Development

An outline for each of the twenty sections of the WEMT curriculum was created by a Task Group of five to twenty selected members, but draws on many published sources and consultants. A Task Group Leader guides the Task Group in reviewing and revising the section, and the Curriculum Coordinator supervises all aspects of curriculum development.

When the outline satisfies the Task Group, it goes to our **Editorial Board**; this includes officers of the ASRC and CEM. It also includes experts in emergency medicine, search and rescue, and education, and a State EMS director. Once acceptable to the Board, it is released to the public.

The Task Group Leader and Editor-in-Chief then produce a Textbook chapter based on the outline. Having a single editor provides a coherent, unified style. Basing chapters on the Task Group's Lesson Plans, as approved by the Editorial Board, ensures accuracy. Each chapter provides a glossary of terms new to a reader with basic EMT and SAR training. In the complete textbook, these glossaries will be merged and alphabetized. Each chapter also provides references to support its statements and for further reading. Background that need not be presented in a class based on the Curriculum appear *in this small, italic font.*

The textbook will be commercially published when completed. All profits will be used to support curriculum development. The textbook will be submitted for publication in 1994. Until then, preliminary versions of the chapters will be printed in this format. These preliminary versions are for use **only** at classes authorized by the Executive Director.

A Course Guide with information about Wilderness Emergency Medical Technician training and course scheduling, will also be available in late 1994; a checklist for recommended in-hospital training is available now. For a price list of available publications, write to: Center for Emergency Medicine, 320 McKee Place, Suite 500, Pittsburgh, PA 15213-4904, (412) 578-3203.

We actively solicit suggestions from anyone reading any of our Lesson Plans or Textbook chapters. Please send your comments to the Editor-in-Chief, as listed on the title page.

# Educational objectives

1. Define pharmacology, and describe the dangers of self medication.
2. Explain the principles of drug administration, including:
   a. eight routes of drug administration;
   b. how two drugs may interact to alter the response of either drug; and
   c. the effects of young and old age, pregnancy, and existing diseases and conditions.
3. Choose the correct definition for the following terms:
   a. indication;
   b. contraindication;
   c. side effect;
   d. toxicity;
   e. allergic reaction; and
   f. abuse.
4. Describe the effect of individual variation on drug dosage, and define "loading dose."
5. Outline the considerations that go into selecting drugs for a personal wilderness medical kit.
6. Given a list of the following medications, identify important contraindications and side effects:
   a. common non-prescription and prescription medications carried by backpackers and other outdoors enthusiasts; and
   b. medications commonly carried in wilderness search and rescue team advanced medical kits.
7. Given a list of clinical situations described in the section on *Wilderness Medical Problems*, and a list of standard oral medications commonly carried in a personal or team wilderness medical kit, choose an appropriate drug, drug dosage, and route of administration.

# Disclaimer

**Recommendations for medical treatment in this curriculum are presented for training purposes only. We have attempted to ensure that all recommendations are consistent with current medical practices, but all care provided by WEMTs must be by the order of a physician. Your physician medical director must set protocols and standing orders, and you must follow them, even if they conflict with the recommendations in this textbook.**

## Notes: *Pharmacology*

This chapter provides the Wilderness EMT (EMT-Basic, EMT-Paramedic, or in between) with an overview of pharmacology oriented to common oral prescription and over-the-counter medications. This causes some to object– they find it immoral to teach pharmacology to EMT-Basics, who cannot administer medications to others. We disagree. Most of those in the outdoors for recreation take a medical kit with them. This includes members of wilderness search and rescue teams. And, since WEMTs will need to deal with team members' medical problems, the more they know about the medications members are taking, the better. (Having WEMTs educated to care for their own minor medical problems is an added benefit.) Some wilderness search and rescue teams' medical directors, in fact, provide team members with prescriptions for a personal wilderness medical kit similar to the one described in this section.

And, the naysayers go on, EMT-Ps already know all about pharmacology. But, what we are teaching is, for the most part, as new to EMT-Ps as to EMT-Basics. (A quick comparison of this with the pharmacology section of the EMT-P curriculum should confirm this.)

Other naysayers hold that EMT-Basics are ineducable, that we cannot teach pharmacology adequately to EMT-Basics. We have disproven this in our Pilot Classes.

Lest it seem that we are training EMTs to go out to play doctor indiscriminately, let us emphasize that we train WEMTs about medications they will encounter in wilderness patients, and to use over-the-counter medications to care for themselves only while in the wilderness; we are firmly in favor of every WEMT having a family doctor for routine medical problems.

# Introduction

## *Definition*

Pharmacology is the study of drugs and their effects on living organisms.

## *Cautions and Warnings*

"The WEMT who treats himself has a fool for a patient."

Realize that the material presented in this section is very limited in scope. We are not training you to practice medicine "on the street"; we are teaching you to handle situations when regular medical care is not available.

You may give drugs to others only by the order of a physician. (This may be on scene, via radio, or via written standing orders.) The actual drugs you are to use are entirely up to your physician medical director and applicable state regulations or laws. (For example, in Pennsylvania, an EMS regulation now prohibits paramedics from giving medications other than those on a specified list. The ASRC-CEM *Wilderness Emergency Medicine Curriculum Development Project* is working, though, to establish another list for Wilderness EMS.) Your doctor may prescribe medications for you to carry in your own medical kit, but you may not legally use these medications to treat others. This applies to nonprescription drugs in your personal medical kit, too. The only exception would be if your medical director's standing orders specifically include giving oral medications.)

If you are an EMT-Basic taking this course, you may wonder why we expect you to learn about pharmacology. There are several good reasons for you to study this material.

You may be on a Field Team without radio communications, and, since you are the local medical expert, a field team member may ask you about one of the medications he has in his medical kit.

You may use this knowledge to build your own personal medical kit from over-the-counter medications. If you work with your personal physician, you can probably add a selection of prescription medication. By being able to treat your own medical problems, you can improve your usefulness as a Wilderness EMT.

You may be faced with patients who are on a variety of prescription medications. Understanding the basics of pharmacology and common oral medications will better help you deal with your patients.

## *Drug Names*

Most drugs have several names. These names fall into three major categories:

**Chemical Name:** this is a description of the chemical structure of the drug. Typically only chemists are interested in this name and it is rarely if ever used in medical publications.

**Generic Name:** the generic name is the name given to the drug by the company that first manufactures the drug. The generic name is most often used in the medical literature.

**Trade Name:** the trade name is the brand name given to a drug by a specific drug manufacturer. The brand name can be recognized by the registered symbol ® (or occasionally the trademark symbol ™) after the name. Since drugs may be marketed by a number of manufacturers, a single drug may have several different trade names. We are often more familiar with the trade name than the generic name of the drug, in part due to intensive advertising by the drug manufacturers. Unfortunately, we may not recognize a drug by its generic name if it is stocked in its generic form in a medical drug kit.

**Example:**
Chemical name: 7-[D-alpha-amino-alpha-phenylacetamido]-3-methyl 3 cephem-4-carboxylic acid monohydrate;

Generic name: cephalexin;
Trade names: Keflex®, Biocef®.

When a drug is first introduced, the company has an exclusive right to sell it. To recoup research costs, the price is usually high. After several years, other companies may sell "generic" versions of this drug, usually at a lower price. These "generics" are often sold under the generic name, but sometimes the company may call it by another new trade name. (The original trade name of amoxicillin was Amoxil®; "generic" versions include generic amoxicillin and other trade names such as Polymox®.)

# Dosage and Administration

Drugs can be administered by a variety of routes:

**PO:** (per os) by mouth;

**SQ or SubQ:** subcutaneous;

**IM:** intramuscular;

**IV:** intravenous;

**SL:** (sublingual) under the tongue;

**PR:** (per rectum) rectally;

Note that many drugs that are designed for PO, IM, or IV use may be given PR. This may be particularly useful in the wilderness. You can grind up pills and mix them with a small amount of binder (e.g., some food) and insert in the rectum.

**Transcutaneous:** through the skin; or

**Endotracheal:** through an endotracheal tube.

## *Drug Interactions*

Drugs can interact in a variety of ways. Two drugs given together can interact to increase or decrease the expected action of either drug, or to increase toxic effects. Examples:

**Increased response:** alcohol increases the drowsiness caused by narcotics such as codeine (e.g., Tylenol#3®) and hydrocodone (e.g., Vicodin®, Anexsia®, Lortabs®), and may even cause coma.

**Decreased response:** antacids (and food) decrease the absorption of the antibiotic tetracycline. Some drugs are absorbed better on an empty stomach, and some better with food.

**Increased toxic effects:** taking erythromycin along with increases the effects of terfenadine (Seldane®) and astemizole (Hismanal®) on the heart, and may result in a type of ventricular tachycardia.

## *Role of the host*

You must consider host factors whenever giving medications.

**Children:** Children are smaller than adults, and dosages for adults may be toxic for children. Doses for children and infants are generally based on body weight. The recommended dosage is based on the known metabolic characteristics of a child of a given size, so you cannot necessarily cut the adult dose in half for a child half the size of an adult.

**The elderly:** The elderly may have decreased excretion of drugs, and increased sensitivity to mind-altering side effects of drugs.

**Pregnancy:** Pregnancy is an important consideration for many medications.

You should regularly ask female patients or team members about the possibility of pregnancy before administering medications. (If the woman has had her last normal menstrual period within the past 10 days, there is only a small chance of pregnancy.)

If the patient is pregnant, remember that you are treating two patients, whether you want to or not, and the fetus is particularly susceptible to damage during its development.

For the pregnant patient, avoid all drugs, if you can. A few "safe" drugs are known:

For pain, acetaminophen is safe (but aspirin and ibuprofen are not safe). For more severe pain, acetaminophen with codeine (e.g., Ty-

lenol#3®), acetaminophen with hydrocodone (e.g., Vicodin®, Anexsia®, Lortabs®), or other narcotics can be used if needed, but are best avoided.

Antibiotics: penicillin, amoxicillin, ampicillin, and erythromycin are generally safe in pregnancy. Ciprofloxacin (Cipro®), norfloxacin (Noroxin®), ofloxacin (Floxin®), tetracyclines, and sulfa drugs (e.g., Bactrim® or Septra®) are not safe.

For "colds": nasal decongestant sprays are generally safe, but oral antihistamines, though not generally thought to cause problems in pregnancy, are best avoided.

### *Existing conditions*

Existing diseases or conditions may influence the choice of medication or route of administration:

**Altered absorption:** A patient in shock may not absorb drugs given PO, IM, or SubQ.

**Altered metabolism:** Patients with liver or kidney disease may develop drug toxicity when given "usual" drug doses, because they have a harder time excreting the drug.

**Side effects:** Potential side effects may cause you to reconsider giving medications such as epinephrine, which may precipitate chest pain or an MI in a patient with coronary artery disease.

## Principles of Drug Treatment

### *Indications*

Indications are the reasons for using a specific drug. Examples:

Antihistamines such as chlorpheniramine (e.g., Chlor-Trimeton®), diphenhydramine (e.g., Benadryl®), terfenadine (Seldane®), and astemizole (Hismanal®) are indicated for allergic problems including allergic rhinitis and sinusitis, skin allergy including poison ivy, and can help infectious rhinitis ("colds"). You can also use over-the-counter antihistamines such as diphenhydramine (e.g., Benadryl®) and chlorpheniramine (e.g., Chlor-Trimeton®) for sedation. (The prescription antihistamines terfenadine [Seldane®], and astemizole [Hismanal®] do not cross the blood-brain barrier, and thus do not cause sedation.)

Erythromycin is an antibiotic that is indicated for skin infections, for bacterial pharyngitis and otitis media in adults. It may be effective for some UTIs.

### *Contraindications*

Contraindications are reasons for not using a specific drug. Some are relative contraindications, others are absolute contraindications. Examples:

Tetracycline antibiotics are almost absolutely contraindicated in children and pregnant women, because they become incorporated in growing bones and teeth, causing weakness and discoloration.

A history of coronary artery disease is a relative contraindication to epinephrine, but if a patient with coronary artery disease is dying of an anaphylactic reaction, you should give the epinephrine anyway.

A history of an anaphylactic reaction to penicillin is an absolute contraindication to giving ampicillin or amoxicillin (both penicillins), and is a relative contraindication to giving a cephalosporin such as cephalexin (e.g., Keflex®). (There is about a 10% cross-allergy between the penicillin and cephalosporin families of antibiotics.)

### *Adverse reactions*

**Side effects:** Side effects are effects, often unavoidable, which are not desired. E.g., most

antihistamines have a side effect of sedation, many antibiotics predispose to yeast vaginitis, and all narcotics, including acetaminophen with codeine (e.g., Tylenol#3®) and acetaminophen with hydrocodone (e.g., Vicodin®, Anexsia®, Lortabs®) tend to cause constipation.

**Toxicity:** Toxicity refers to unwanted effects related to the amount of drug given (e.g., marked sedation and respiratory depression with large doses of codeine, hydrocodone, or morphine).

**Allergic reactions:** Allergic reactions are based on the sensitivity of the patient to specific drugs, and range from mild rashes to anaphylactic reactions. Most allergies to drugs are minor rashes that can be controlled with an antihistamine. (Allergy is discussed further in the section on *Wilderness Medical Problems.*)

**Abuse:** is the nontherapeutic use of a drug (e.g., use of codeine or hydrocodone for euphoric effects rather than for pain).

### *Dosage*

You must individualize the dosage of a drug to the patient and the problem.

**Individual variation:** Even given the effects of age, pregnancy, and pre-existing conditions, people vary in their response to medications. For example, smokers have increased enzymes in the liver. This leads them to excrete certain drugs (e.g., aminophylline) faster than non-smokers. Another example is aspirin, when used as an anti-inflammatory drug. Because of individual variation, some doctors use a toxic side effect as a measure of the appropriate dosage: ringing in the ears (tinnitus). Patients on large doses of aspirin are told to cut down on their dosage if they develop tinnitus.

**Loading doses:** If you need the effect of a drug immediately, and the drug effect is dependent on the blood level, then it is common to give a loading dose to rapidly build up the blood level. For instance, if you start taking 250 mg of amoxicillin three times a day for an ear or sinus infection, it will take 5-6 doses to build up to an acceptable steady-state blood level. If, however, you take two 250 mg capsules to begin with, your blood level rapidly climbs to the appropriate level. Your level then stays (relatively) constant as you take 250 mg three times a day. An interesting fact is that, though you may need to decrease the amount of a drug you take each day if you have kidney failure, the loading dose is still the same.

## Chronic Medications

Wilderness SAR teams often find and rescue people who have been on medications for chronic problems. The question often arises whether it is necessary to continue (or restart) the medication. This is a complex question and best dealt with by a Wilderness Command Physician. However, many command physicians not familiar with wilderness problems will refuse to allow you to administer such medications. We are aware of one cave rescue in which a person was uninjured but trapped for a long period of time. The command physician (not a Wilderness Command Physician) did not allow EMTs on the scene to administer the patient's regular anticonvulsant as originally prescribed, and the patient apparently had a seizure and died. While we cannot provide guidelines for the use of every chronic medication, we wish to present certain common medications and the principles behind decisions whether to reinstitute them or not.

### *Insulin*

Those who need injections of insulin and are deprived of it become hyperglycemic (get a high blood sugar), leading to an increased urine output and marked dehydration.*

*Diabetics are classed into Type I and Type II.*

*Type I, which was also known as Juvenile-Onset Diabetes Mellitus, is called Insulin-Dependent Diabetes Mellitus (IDDM), because the person has essentially no self-produced insulin. Type I*

*diabetics easily go into diabetic ketoacidosis ("DKA"). Ketoacidosis occurs because insulin is needed for blood sugar to enter cells. Cells without glucose must subsist on fat alone, and produce ketoacids. Ketoacidosis may be fatal within a few days.*

*Patients with Type II or Non-Insulin-Dependent Diabetes Mellitus (NIDDM, which used to be called Adult-Onset Diabetes Mellitus) still have some insulin production of their own. This is generally enough to prevent ketoacidosis. However, Type II diabetics without insulin still may suffer from hyperglycemia and dehydration. Indeed, the hyperglycemia may become so severe that the patient develops Hyperosmolar Nonketotic Coma simply from the osmotic effects of the high glucose.*

Insulin does not keep long without refrigeration,*[1] and thus you'll seldom have it in your wilderness medical kit (unless searching for or rescuing a known diabetic). However, hydration is more important than insulin for most diabetics who have low levels of insulin. Even if you have blood glucose sticks ("dextrosticks") and can monitor blood sugar levels, and you have insulin, there is no hurry to tightly control the blood glucose level. If you have insulin, give only small amounts (e.g., 5 units IV every hour) to keep glucose going into cells. This will keep the patient out of ketoacidosis. Wait until later for fine-tuning of the blood sugar, in a more controlled environment.

## *Antihypertensives*

Most search subjects on an antihypertensive drug will not need it after being dehydrated and salt-depleted.

An exception would be a person who was on a beta-blocker such as propanolol (e.g., Inderal®), atenolol (e.g., Tenormin®), or metoprolol (e.g., Lopressor®). Beta-blockers are well-known to cause a severe "rebound" hypertension when stopped abruptly. If such a person has been without the beta-blocker for a day or two, **and** the diastolic BP is above 110, a beta-blocker such as propanolol (e.g., Inderal®) should generally be reinstituted immediately.

## *Anticonvulsants*

The Appalachian Search and Rescue Conference, reviewing its statistics, has noted that a disproportionately large number of lost people are epileptics on anticonvulsant medications. The reason for this is not clear. Regardless, you must expect to occasionally be confronted with such a patient. You may find a patient who is trapped, or who will require a long evacuation, and who has been without anticonvulsant medication for hours or days.

Common anticonvulsants such as phenytoin (Dilantin®), phenobarbital, and carbamazepine (Tegretol®) have few acute side effects or toxicity when given orally, and thus providing doses to a wilderness patient makes sense. Phenobarbital and to a lesser extent phenytoin (Dilantin®) may cause mild sedation, and thus might be theoretically contraindicated after a head injury. However, a standard treatment for head injuries is to administer phenytoin (Dilantin®) or phenobarbital to prevent seizures, so head injury is not a contraindication for these drugs.

Anticonvulsants have a long half-life. If a patient has been off the medicine for a long time, it may take many days of the patient's "regular" dose to get back up to a therapeutic blood level. Thus, simply starting back on the normal dose is unlikely to do much to prevent seizures during rescue or evacuation unless you give a **loading dose**. For example, the standard dose of phenytoin (Dilantin®) is 300 mg once daily, or 100 mg three times a day. If an adult

* When blood glucose levels are higher than a certain level, the glucose comes out in the urine. And, since the kidney can only concentrate urine a certain amount, the kidney loses water with the glucose, even if the person is dehydrated and the kidney is trying to hold onto water.
* 30 days

has been without phenytoin for several days or who has never been on it, however, the loading dose for a 70 kg (150 lb.) adult is 1200 mg, given in several doses an hour apart (e.g., 300 mg every hour for four hours). For phenobarbital, the loading dose is roughly 180 mg, even though the normal dose is 30 mg three times a day.

### *Psychiatric medications*

Many search and rescue subjects have chronic psychiatric problems, and may be taking one or more psychiatric medications. In general, none of these need to be restarted during a long rescue or evacuation, unless the person is violent or combative. In such cases, haloperidol (Haldol®) 1 to 5 mg, either PO or IM, is an appropriate drug treatment. Since your immediate goal is sedation, not correcting the underlying psychiatric problem, you can use other sedatives if you don't have any haloperidol. Other methods for dealing with psychotic patients are provided in the section on *Principles of General Medicine*, and sedation and tranquilization are discussed below.

## Medical Kits

The topic of wilderness medical kits always causes much discussion and controversy. Since the prescription medications in any medical kit are the prerogative of the prescribing physician, kits tend to vary. Our discussion will focus on two kinds of kits: the Personal Wilderness Medical Kit, and the Wilderness ALS Medical Kit.

### *Personal Wilderness Medical Kit*

The contents of a personal wilderness medical kit depends on:

* medical problems in the group you're traveling with;
* medical problems that are common where your group plans to travel (e.g., high altitude, tropical diseases);
* the group's level of medical training;
* weight and size constraints;
* the environment (e.g., insulin and suppositories will not last long in hot environments);
* the expected distance to medical facilities;
* the number of people in your group; and
* the length of trip.

A series of articles in a medical journal treats the topic of personal medical kits at length;[2,3,4] Auerbach's *Medicine for the Outdoors*,[5] Darvill's *Mountaineering Medicine*,[6] Forgey's *Wilderness Medicine*,[7] Steele's *Far from Help*[8], Wilkerson's *Medicine for Mountaineering*,[9] and *Mountaineering First Aid*[10] all contain discussions of medical kit contents. Bezruchka's book on medicines for foreign travel provides useful guidelines for the wilderness traveler, too.[11] We present a sample personal wilderness medical kit, with comments on each selection, in Table 1.

### *Wilderness ALS Medical Kit*

We present a suggested wilderness rescue team ALS drug list in Table 2. The section on *Packaging and Transportation* presents a list of recommended equipment for such a kit.

### *Drug Storage*

Wilderness medical kits must withstand hard use. Many drugs carry cautions to "store at controlled room temperature." While you should do whatever you can to keep your wilderness medical kit drugs away from extremes of heat and cold, it's sometimes impossible to avoid freezing of liquid drugs. The following drugs are altered by freezing, and thus you might want to avoid them when choosing drugs for

your wilderness ALS kit: Sus-Phrine® epinephrine suspension; hydrogen peroxide solution; NPH insulin; ketamine HCl injection; magnesium sulfate solution; mannitol injection 25%; milk of magnesia; prednisolone acetate (Pred-Forte®); and sodium bicarbonate injection. Decadron® (dexamethasone) is unsafe after freezing, but Decadron® Sodium Phosphate (dexamethasone phosphate), which is roughly equivalent, is safe after freezing. A list of drugs that are reported as safe after freezing and thawing is presented in Table 3.[12,13,14]

# Wilderness Medical Kit Drugs

## *Analgesics/Antipyretics/NSAIDs*

Analgesics can be subdivided into several categories, each of which has its own specific uses and contraindications.

### Acetaminophen

Acetaminophen (e.g., Tylenol®) is probably the most commonly used analgesic. (It is also known in some English-speaking countries by the generic name paracetamol.) It is effective for mild pain, and will reduce fever. Tablets and capsules come in 325 mg and 500 mg sizes. The usual adult dose is two 325 mg tablets (650 mg) every four hours as needed for pain or fever. A liquid form for children is dosed based on weight. While acetaminophen is safe when used in recommended dosages for a short period, a deliberate or accidental overdose (for an adult, 5 to 10 grams = 15-30 regular strength tablets, taken at once) will almost invariably result in irreversible liver failure 3 days later. Chronic use of acetaminophen, over the course of years, may also cause kidney damage.

### Aspirin

Aspirin is the oldest analgesic.

It relieves mild pain just like acetaminophen, and the dosage is the same.

Aspirin is not as toxic to the liver as acetaminophen when taken in overdosage. However, it is well-known for causing stomach upset when taken on an empty stomach, and may cause ulcers if taken on a regular basis.

When taken in small doses (one tablet a day or even less) aspirin, unlike acetaminophen, tends to decrease the stickiness of platelets and thus acts as a mild "blood thinner." This anti-platelet effect has led to widespread use of an aspirin a day to prevent strokes and heart attacks. However, this blood thinning effect also means that aspirin would not be an appropriate analgesic for anyone with possible bleeding problems. For example, you would not want to give aspirin to a person with tenderness over the spleen after a fall, or a person who has sustained a major head injury. People should avoid aspirin in cases of chicken pox, aspirin allergy, gastritis or possible ulcer disease, reflux, or bleeding problems.

### NSAIDs

NSAIDs are Non-Steroidal Anti-Inflammatory Drugs.

**Ibuprofen**, now available over the counter in 200 mg tablets as Advil®, Nuprin®, and by other names, is the most well-known NSAID. (It is also available in liquid form as Pedipren®.) The original trade name for ibuprofen was Motrin®. NSAIDs are somewhat stronger than acetaminophen or aspirin when taken for mild to moderate pain (e.g., 2 over-the-counter 200 mg ibuprofen tablets instead of 2 acetaminophen tablets).

Like aspirin and acetaminophen, NSAIDs help reduce fever.

When taken in larger doses (e.g., ibuprofen 600 mg four times a day, or 800 mg three times a day), NSAIDs also have an anti-inflammatory effect. This effect does not occur when NSAIDs

are taken in lower doses just for pain. The anti-inflammatory effect takes a day or two to develop, and is used primarily for inflammatory problems such as rheumatoid arthritis. Some believe that this anti-inflammatory effect may be useful with a significant sprain or other injury that will take a long time to heal, but others doubt this.

NSAIDs may rarely cause renal failure, especially in patients with uncorrected hypovolemia or dehydration.

Like aspirin, NSAIDs are known to cause stomach upset, and long-term use may lead to ulcers or GI bleeding, especially in the elderly. Sometimes elderly people on NSAIDs may develop massive bleeding without any signs before the GI bleed.

You can use aspirin itself as a NSAID if taken in large enough doses (16-20 a day). However, this large a dose often causes severe stomach upset, and other NSAIDs are generally preferred.

Other prescription NSAIDs include piroxicam (Feldene®), naproxen (Naprosyn®), indomethacin (Indocin®), diflunisal (Dolobid®), sulindac (Clinoril®), and diclofenac (Voltaren®).

**Ketorolac** tromethamine (Toradol®) is a potent NSAID that has recently (1990) become available. At present it is the only NSAID available for IM use. Like the other NSAIDs, ketorolac has anti-inflammatory and analgesic effects. In clinical studies, ketorolac 30 mg IM provided pain relief comparable to the narcotic agent meperidine (Demerol®) 100 mg IM or morphine 12 mg IM. However, the oral form does not seem significantly better than other NSAIDs. Unlike morphine and other narcotics, it causes little or no sedation, causes little or no respiratory depression, and is not addicting. Like other NSAIDs, however, long-term use can cause ulcers or contribute to kidney failure. For wilderness patients with pain, ketorolac is ideal because you can give it without fear of masking neurological changes or compromising respirations. Though there is some theoretical decrease in clotting function from NSAIDs including ketorolac, this is probably not a reason to withhold it from wilderness patients with severe pain, unless there is uncontrolled bleeding.[15,16,17,18,19,20] Ketorolac has replaced much of the morphine in many advanced wilderness medical kits. However, morphine still has some advantages over ketorolac, for instance in pulmonary edema, or when you **do** want sedation.

## Narcotics

Narcotics have been around as long as aspirin (nobody knows for sure how long). The very name "narcotic" suggests narcotics' ability to induce sleep. However, their main utility for the WEMT is their ability to counteract strong pain **without** inducing sleep.

First we must make a distinction between the medical (pharmacologic) definition of narcotics and the legal definition of narcotics.

Medically, narcotics are morphine and chemically-related compounds that have similar effects: marked pain relief, mild sedation, constipation (or control of diarrhea), cough suppression, and sometimes euphoria.

Legally, at least in the U.S., narcotics are drugs defined as dangerous in a certain legal sense.

"Legal narcotics" include dangerous and addicting non-narcotic drugs such as cocaine, and nearly-innocuous and non-addicting drugs such as marijuana, yet the definition excludes other dangerous and addicting drugs, including tobacco and ethanol.

Narcotics are well-known for their abuse potential. The euphoric effect of narcotics, and their addictive potential, has led to a large population of people dependent on narcotics (but not nearly so large as those addicted to tobacco and alcohol). Short-term use of high doses of narcotics in a patient with severe pain, however, has been shown not to cause any danger of addiction.

**Morphine** is the "classic" narcotic, and IV morphine is still the standard against which other narcotic analgesics are measured. The primary effects of morphine include:

* strong analgesia,
* sedation (leading to respiratory depression if used to excess),
* nausea and occasionally vomiting,
* suppression of cough, and
* suppression of intestinal motility, leading to control of diarrhea (or perhaps to constipation).

With certain of the narcotics, one effect predominates over the others. Some narcotic derivatives, such as diphenoxylate (e.g., Lomotil®), loperamide (Imodium®), and dextromethorphan, are chemically related to morphine and share many of its effects, yet have a low addiction potential and thus are not "legally" narcotics.

Diphenoxylate (e.g., Lomotil®) and loperamide (e.g., Imodium®) decrease intestinal motility, but have few other effects.

Dextromethorphan (found in Robitussin®-DM cough syrup, for example) suppresses cough but has few other narcotic effects. (For wilderness use, cough syrups are too heavy to carry. For wilderness medical kits, dextromethorphan is available in over-the-counter Hold™ cough drops, each with 5 mg of dextromethorphan (available from Menley and James Labs, Commonwealth Corporate Center, 100 Tournament Drive, Horsham, PA 19044, 1-800-321-1834). Prescription-only 30 mg sustained-release dextromethorphan tablets are available, too. (Humibid-DM: Adams Laboratories, Ft. Worth, TX 76118).)

Most personal wilderness medical kits contain a general-purpose oral narcotic (e.g., acetaminophen with codeine, or acetaminophen with hydrocodone) which has all narcotic effects and you can use for a variety of problems. Most people add diphenoxylate (e.g., Lomotil®) or loperamide (Imodium®) for the control of diarrhea, though the codeine or hydrocodone will work if you only want to carry one narcotic.

There are several contraindications to narcotic pain medication:

**In shock:** Narcotics tend to cause vasodilation, which may worsen shock; narcotics may also mask some symptoms, making assessment more difficult, and perhaps lulling you into a false sense of security about your patient's condition.

**In head trauma:** Narcotics may decrease the level of consciousness and thus make the patient's neurological status seem worse. Too, narcotics may cause respiratory depression, increasing blood $CO_2$ levels, and thus causing vasodilation in the brain, with attendant increases in intracranial pressure (ICP). However, agitation from pain can cause increased ICP, too.

**In chest trauma:** Narcotic respiratory depression may diminish respirations in someone who already has respiratory compromise from trauma. On the other hand, those with rib fractures will generally "splint" and not fully expand the lung on the injured side due to pain. Over a long evacuation this may lead to atelectasis (collapse of small sections of the lung) or pneumonia. Pain medication is thus the mainstay of treatment for rib fractures.

**In abdominal trauma:** Repeated abdominal examinations are the key to diagnosis of a surgical abdomen, and narcotics may make a patient who needs immediate surgery look like one who doesn't. However, you (or the hospital) can use naloxone (e.g., Narcan®) to reverse the narcotic effect if necessary for a surgeon's exam. There is also some suggestion that narcotics may worsen internal bleeding.

However, these reasons for not treating pain with narcotics are not absolute. In fact, for prolonged transport of a patient in severe pain, pain medication will probably be the routine. However, to keep narcotics from causing problems for the wilderness patient:

* obtain a direct order from your Wilderness Command Physician whenever possible,
* monitor the patient's neurological status carefully,
* monitor the patient's respiratory status carefully (remember, respiratory depression may cause neurologic damage even without respiratory arrest), and

* use the minimum amount of narcotic to provide relief.

Most Wilderness Command Physicians will ask WEMT-Ps to "titrate" to find an appropriate dose for each individual patient. (Titrating means giving the narcotic slowly through the IV, while observing the patient closely, until you achieve relief of the pain.)

Morphine is available in pills (which can also be used rectally). If you have the injectable form of morphine, but can't start an IV, you can give the injectable form sublingually.

Transdermal patches with the narcotic fentanyl (Duragesic™) are available. They are very light, provide strong pain relief, and may be carried in some wilderness medical kits. Though you cannot reduce the dosage by cutting a Duragesic™ into fractions as with the Trans-Derm Scop™ patches, but can "mask" part of the skin side of the patch with a small amount of adhesive tape, then tape the patch in place.

### Local Anesthetics

**Oil of Cloves (Eugenol):** Oil of cloves is a local anaesthetic and antiseptic that is commonly used by dentists. When you apply it to a painful gum or painful fractured tooth, it will often produce immediate and dramatic relief of the pain. You can mix it with zinc oxide powder to produce a temporary filling for a cracked tooth or a lost filling.

**Phenazopyridine hydrochloride (Pyridium®):** Phenazopyridine is a chemical compound that, when excreted in the urine, causes the urine to turn bright orange. As a local anesthetic, it relieves much of the bladder irritation and the constant need to urinate caused by a bladder infection.

**Sting-Eeze™:** Sting-Eeze™ is an over-the-counter mixture of a variety of local anaesthetics sold for use on insect bites and stings. Many "unit" first aid kits also contain a similar formulation called Sting-Kill™ in disposable swabs. Another similar formulation is called "Itch Balm." These solutions are reasonably effective, but most contain benzocaine, which can sometimes cause allergy.

The juice of the Jewelweed plant, commonly found in swampy areas along many Eastern trails, is good for nettle stings and many other kinds of bites and stings, but not for plant contact dermatitis (e.g, poison ivy).[21]

**Pramoxine** (Prax™) is local anaesthetic cream that is not known to cause allergy or other irritation. At present, it is available only by prescription; in the near future, it may be available without a prescription.

## *Antihistamines*

Histamine is the primary "middleman" in many allergic problems, e.g., hives (urticaria), hay fever, poison ivy, and allergic conjunctivitis. Antihistamines block the "H1" (histamine #1) receptor responsible for the effects of histamine, and can relieve much of the itching and swelling associated with allergy. "H2 blockers" block the effects of histamine on acid secretion in the stomach. Common H2 blockers, including ranitidine (Zantac®) and cimetidine (e.g., Tagamet®), are often prescribed for ulcer disease. They have also recently been found to be effective in treating urticaria (hives) from allergy.

**Non-Sedating Antihistamines - Terfenadine (Seldane®) and Astemizole (Hismanal®):** terfenadine (Seldane®) and astemizole (Hismanal®) are new, prescription-only antihistamines that do not cross the blood-brain barrier and thus do not cause sedation. This is an advantage when you want an antihistamine effect but need to avoid drowsiness. Unfortunately, these are not as strong as other (sedating) antihistamines such as diphenhydramine (e.g., Benadryl®), and they are expensive. Unlike diphenhydramine, they cannot be used as a "sleeping pill" or for sedation.

**Do not take erythromycin together with terfenadine (Seldane®) or astemizole (Hismanal®). Do not take more than the recommended dose of these terfenadine (Seldane®) or astemizole (Hismanal®). The increased**

**drug levels may be toxic to the heart, resulting in a form of ventricular tachycardia.**

**Over-the-Counter Antihistamines - diphenhydramine (e.g., Benadryl®), chlorpheniramine (e.g., Chlor-Trimeton®), and others:** All over-the-counter antihistamines cause sedation, diphenhydramine (e.g., Benadryl®) more than chlorpheniramine (e.g., Chlor-Trimeton®). The sustained-release form of chlorpheniramine has the advantage (or disadvantage, depending on your purpose for using it) of lasting 12 hours compared to only 4-6 hours for diphenhydramine (e.g., Benadryl®).

## *Decongestants*

The nasal mucosa may become swollen from allergy, from viral or bacterial infection, or from trauma. Nasal congestion is much worse when you are lying flat due to increased venous pressure in the nose. Being unable to breathe through your nose is a vexing problem. In addition to elevating the head (i.e., sleeping on two pillows), many medications are available to help with the problem. Antihistamines (described above) can give some relief, especially when allergy is the cause. However, the main drugs used for this are the decongestants. You can either take an oral decongestant or apply one directly in the form of nasal spray or drops. Unlike antihistamines, decongestants are related to epinephrine, and thus tend to cause increased pulse and blood pressure, restlessness, and sleeplessness. Also like epinephrine, they can be of some use for asthma if you have no better medications. Many cough and cold preparations combine an antihistamine and a decongestant, but for most wilderness medical kits, people take separate ones for more flexibility in their use e.g., you can use diphenhydramine (e.g.,Benadryl®) for sedation, and you might use pseudoephedrine (e.g., Sudafed®) for asthma. Nasal sprays have the advantage that they cause virtually no significant systemic symptoms, because they are not significantly absorbed. However, they lose their effectiveness over a few days, and users may even become addicted to them (addicted in terms of requiring the nasal spray to be able to breathe at night, not in terms of any euphoric effect).

**Oral Decongestants:** Pseudoephedrine (e.g., Sudafed®) is the most well-known decongestant. The original Sudafed® (pseudoephedrine) now is joined by a variety of other Sudafed® preparations, including antihistamines and combinations. Pseudoephedrine is available in over-the-counter 30 mg pills to be taken one every 6 hours, and also in prescription-only 60 mg tablets, also to be taken one every 6 hours. You may take two over-the-counter 30 mg tablets to get same effect as one prescription tablet.

**Nasal Sprays:** Oxymetazoline (e.g., Afrin®) nasal spray has replaced phenylephrine (e.g., Neosynephrine®) nasal spray in most wilderness medical kits, because oxymetazoline lasts 12 hours compared with phenylephrine's 6 hours. You can now find many inexpensive generic forms of oxymetazoline spray.

## *Adrenergic Agents*

Adrenergic agents are drugs related to the hormones put out by the adrenal medulla, such as adrenaline (epinephrine).

**Anaphylaxis kit including epinephrine:** In addition to the adrenergic decongestants discussed above, many wilderness travelers carry epinephrine (adrenaline) itself in injectable form. Epinephrine is the only immediate treatment for anaphylaxis, and is a good treatment for asthma. Two kinds of epinephrine kit are commercially available in the U.S. The **Anakit™** contains a Tubex™ syringe ampule with 1cc of a 1:1000 solution of epinephrine in a plastic syringe. Pressing the plunger injects half the Tubex™, then twisting the handle allows you to inject the other half if needed. The **Epi-Pen™** contains an auto-injector which injects epinephrine when you press it against the skin.

**Inhaler:** A variety of inhaled adrenergic agents are available for the treatment of asthma and other bronchospastic disorders. Albuterol (e.g.,

Proventil®, Ventolin®) is one of the most commonly used. These inhaled agents can be quite effective for asthma. However, as with epinephrine, they may cause hypertension, increased stress on the heart leading to arrhythmias, angina, or myocardial infarction, especially if used to excess.

## *Steroids*

Steroids (also known as corticosteroids) are drugs related to hydrocortisone, the hormone produced by the adrenal cortex. In low doses, hydrocortisone is a normal part of the body's functioning. In higher doses, steroids have a number of effects including a strong anti-inflammatory effect via a different mechanism from the NSAIDs.

Short-term use of steroids (a week or two) cause few side effects. However, they can raise blood sugar, and can raise blood pressure by causing fluid retention. Longer use of steroids may cause thinning of the bones and skin, and atrophy of the adrenal cortex. After a long course of steroids, sudden withdrawal may cause problems. It may not allow the adrenal cortex enough time to "gear up" and produce its own hydrocortisone. This may result in severe illness or even death.

There is no significant difference between oral/IV steroids except that it takes a large amount of prednisone to equal the effects of dexamethasone or methylprednisolone.

**Oral/IV/IM Steroids:** Prednisone pills are found in many personal wilderness medical kits. People carry prednisone for severe allergic reactions that don't respond to antihistamines. A good example is a severe case of poison ivy. Dexamethasone (e.g., Decadron®) is a very strong steroid available in oral or IV form. It may be used for the treatment of high altitude cerebral edema (discussed further in the chapter on *Altitude Illness*). It also helps recovery in cases of spine injury. Methylprednisolone (e.g., Solu-Medrol®), used in IV form, is a common wilderness ALS medication used for asthma, bronchospasm, and spinal cord injury.

**Steroid Creams:** Steroid creams are useful for poison ivy, mosquito bites, and a variety of allergic rashes. There are many, many brands and types of steroid creams and ointments, ranging from the over-the-counter 1/2%-1% hydrocortisone cream (e.g., Cortaid®), which is very weak, but often enough to help minor allergic problems, to creams hundreds of times stronger. None except the strongest cause suppression of the adrenal cortex. Brand names of moderately strong prescription-only creams commonly carried in wilderness medical kits include Kenalog®, Valisone®, Aristocort®, Benisone®, Diprosone®, Diprolene®, Topicort®, Lidex®, Topsyn®, and Westcort®. Never use these strong steroid creams on the face, except possibly for a very short course for a severe inflammation such as blistering poison ivy. Continued use may result in ugly telangectasias (permanently dilated blood vessels) and thinning of the skin. Don't put steroids on infected wounds, since steroids decrease your body's ability to fight infection.

## *Antacids*

Antacids are seldom lifesaving, but may be worth quite a bit to someone with severe stomach hyperacidity or gastroesophageal reflux. A single dose of antacid four times a day (an hour after every meal and at bedtime) is also an effective treatment for peptic ulcer disease.

## *Motion-sickness Drugs*

All drugs for motion sickness work best when you take them before the inciting motion starts.

**Meclizine (e.g., Bonine®, Antivert®):** Meclizine is moderately effective for motion sickness. It is available in both over-the-counter (Bonine®) and prescription (Antivert®) 25 mg tablets. The chewable tablets are best because you can take them with minimal swallowing (impor-

tant for someone who already has motion sickness). Bonine® tablets are chewable, and one form of Antivert® is chewable.

**Dimenhydrinate (Dramamine®):** Dimenhydrinate has been available as an over-the-counter drug for many years. It is very similar to meclizine, and also available in chewable form. Both dimenhydrinate and meclizine may cause significant drowsiness.

**Trans-Derm Scop:** Trans-Derm Scop (pronounced "transderm scope") patches provide a multi-day sustained release transdermal administration of scopolamine, which has been found highly effective against space sickness by NASA. In order to get a loading dose of scopolamine into the system quickly, however, the patch's glue contains a very high concentration of scopolamine. Numerous cases of "blown pupils" have been reported due to people getting a bit of the glue on their fingers when applying the patch, then rubbing an eye. The patches only come in a single size, and the dosage may be a bit high for some small people or those particularly sensitive to the drug. However, you can cut a patch in half (or any other fraction) and will still be effective. Possible side effects include dry mouth, blurred vision, nausea, lightheadedness, and difficulty concentrating, and urinary retention; some older people may have frank psychotic reactions to scopolamine patches.

## *Anti-nausea Drugs*

Some medications are more effective for motion sickness (described above), and others are more effective for nausea and vomiting from other causes (e.g., viral gastroenteritis). Any anti-nausea drug may cause a severe and debilitating side effect called a **dystonic reaction.*** The patient may have involuntary muscle spasms causing arching of the back, twisting of the head from side to side, and sometimes facial twitching or tongue-thrusting. This dystonic reaction is not related to the amount of the drug used, and there is no way to predict who will develop it. You can rapidly and effectively treat it with oral or IM diphenhydramine (e.g., Benadryl®) (or any other antihistamine).

**Prochlorperazine (e.g., Compazine®):** Prochlorperazine is one of the drugs most commonly prescribed for nausea and vomiting from gastroenteritis or pain. It may cause dystonic reactions as described above, and may cause mild sedation. It is available in pills, as an IM/IV injection, and as suppositories. The normal adult dose is 5-10 mg every 4-6 hours as needed.

**Other Antinausea Drugs:** Other common prescription-only antinausea drugs include metoclopramide hydrochloride (e.g., Reglan®), trimethobenzamide hydrochloride (Tigan®), and thiethylperazine maleate (Torecan®). All act similarly to prochlorperazine (Compazine®). Over-the-counter medications that may be somewhat effective against nausea include antihistamines like diphenhydramine (e.g., Benadryl®) and chlorpheniramine (e.g., Chlor-Trimeton®), and the drugs used for motion sickness (see above).

## *Anti-motility Drugs*

Loperamide hydrochloride (Imodium®) and diphenoxylate hydrochloride (e.g., Lomotil®) are narcotic derivatives that have few narcotic effects other than slowing the peristaltic activity of the intestines. Diphenoxylate, because of worries about possible abuse by narcotic addicts, has a small amount of atropine added to each tablet. The amount of atropine added is very small, and should cause no side effects at normal dosages. A generic form of diphenoxylate is now available, and is very inexpensive. Diphenoxylate

* A dystonic reaction is a special, very severe, type of extrapyramidal symptom. Other involuntary movements due to the extrapyramidal motor system are also possible.

tablets have the advantage of being small, hard pills, and thus are light and travel well. Loperamide (Imodium®) is relatively expensive but, unlike diphenoxylate, is available without a prescription (Imodium® AD). You can use any of the narcotics (e.g., codeine, hydrocodone) to control diarrhea, but you must expect "side effects" of analgesia and sedation.

## *Eye Medications*

**Eye Anaesthetics:** Tetracaine and proparacaine drops are commonly used to anesthetize the eye to allow an eye exam. However, they are thought to interfere with healing of abrasions if used on a regular basis for pain control (though there are no good studies to show this). Adequate anesthesia of the eye is extremely helpful in evaluation of a painful eye, and for removing foreign bodies from the eye.

**Pupil Dilators (Cycloplegics):** Cyclopentolate (e.g., Cyclogyl®) is used to dilate the pupil. The effect lasts for roughly a day. Emergency Department doctors and eye doctors routinely use one or two drops of cyclopentolate for patients with corneal abrasions or snowblindness. This relaxes the spasm of the eye muscles that causes most of the pain after such injuries. Never use cyclopentolate for anyone who has a narrow anterior chamber of the eye, because it might cause severe glaucoma (see the section on *Wilderness Medical Problems* for more about this.) Other dilating drops sometimes found in wilderness medical kits include homatropine (long-acting: many days), and phenylephrine (e.g., Neosynephrine®) and tropicamide (shorter-acting).

**Eye Antibiotics:** Sulfacetamide is a sulfa antibiotic commonly used as drops in cases of suspected infectious conjunctivitis or as ointment when a corneal abrasion is patched. Other antibiotics commonly used in the eye include gentamicin, tobramicin, and Neosporin®. Neosporin® is a combination of three antibiotics: neomycin, polymyxin, and bacitracin, and is generally not recommended, because a sizable number of people develop an allergy to the neomycin. Polysporin® contains just polymyxin and bacitracin, and is a reasonable alternative. Plain bacitracin eye ointment is also available, and is good choice for wilderness medical kits.

**Cortisporin® Ointment:** Cortisporin® ophthalmic ointment is a combination of the three Neosporin® antibiotics along with a steroid. It is popular in many wilderness medical kits with the idea that, since it contains so many drugs, putting it in the eye is bound to do something useful. However, steroids placed in the eye make viral and fungal infections much worse. A standard medical recommendation is that only an ophthalmologist should prescribe steroid eye medications.

**Fluorescein Strips:** Though you can see many corneal abrasions with only the shallow, oblique light of a penlight, abrasions are much easier to see when you put a drop of fluorescein solution in the eye. Abrasions take up the stain and appear greenish. Fluorescein fluoresces (glows) in ultraviolet light, thus its name. In the Emergency Department, doctors use special blue "cobalt filter" or ultraviolet lights to see abrasions stained with fluorescein. However, fluorescein dye helps highlight abrasions even with a penlight or daylight. Strips of filter paper coated with fluorescein are available. You can wet one with a drop of sterile anaesthetic solution or water, and touch it to the inner part of the lower eyelid, staining the eye. (The dye is water soluble and non-staining, and has no known side effects. Normal tearing will wash the dye away in an hour or so.) Best of all, a few of the strips add virtually nothing to the weight of a wilderness medical kit.

## *Antimicrobials:*

Strictly speaking, "antibiotics" are chemicals synthesized by one microorganism for use against another: penicillin is an example of a chemical made by the *Penicillium* bread mold to protect it against bacteria. The term antimicrobial also includes synthetic chemicals used to

fight certain microorganisms. However, almost everyone uses the word antibiotics when we mean antimicrobials. We will continue this common usage.

### Oral and IV/IM Antibiotics

**"Plain" penicillin (e.g., Pen-V-K®):** Penicillin is the oldest known antibiotic. It is effective against many of the anaerobic bacteria found in the mouth (e.g., with an infected tooth or cheek), and against the streptococcus that causes strep throats and strep cellulitis. However, many other bacteria have defenses against it. It is not effective against gram-positive pus-forming bacteria such as Staph, or against many gram-negative bacteria that cause ear infections, UTIs, or against the anaerobic bacteria found in the gut. Penicillin is safe for pregnant women. Few people carry plain penicillin in their wilderness medical kits.

**Amoxicillin:** Amoxicillin is a modified form of penicillin. It is not as effective as penicillin against mouth anaerobes, but still fairly good. However, it kills many more gram negative bacteria, and thus is popular for ear infections and UTIs. (Ampicillin is virtually the same but must be taken four times a day compared with three times a day for Amoxicillin). Amoxicillin is safe for pregnant women. Patients with allergies to penicillin should avoid amoxicillin. Amoxicillin is very cheap.

**Amoxicillin-clavulanate (Augmentin®):** Augmentin® is amoxicillin with an additional drug (clavulanate) that overcomes the resistance to amoxicillin of many bacteria. It is good for skin infections including mammal bites, and even better than amoxicillin for ear infections, respiratory infections, and UTIs. Unfortunately, it is a new drug and very expensive. Amoxicillin-clavulanate also tends to cause diarrhea. Those with allergies to penicillin should avoid amoxicillin-clavulanate. Amoxicillin-clavulanate is a popular drug for wilderness medical kits.

**Erythromycin:** Erythromycin is a common substitute for penicillin, amoxicillin, and amoxicillin-clavulanate (Augmentin®) for those allergic to penicillin. Therefore, it is used to treat ear infections, and skin infections. However, it does not kill one gram negative organism (*H. Flu.*) that occasionally causes ear infections and UTIs, especially in children. It does, however, kill almost all of the organisms responsible for pneumonia in otherwise healthy people. Erythromycin is safe for pregnant women. Erythromycin may cause stomach upset, particularly if taken on an empty stomach, so it should be taken with food. Erythromycin is found in some wilderness medical kits. **Do not take erythromycin together with terfenadine (Seldane®) or astemizole (Hismanal®). The combination may be toxic to the heart, resulting in a form of ventricular tachycardia.**

**Cephalosporins:** Cephalosporins are a large family of antibiotics related to but different from the penicillins. About 10% of those allergic to penicillins are allergic to cephalosporins and vice versa. There are several "generations" of cephalosporins, with many of the newer (second and third generations) covering many of the "nasty" bugs found almost exclusively in debilitated people in hospitals. These newer drugs are of little use for the wilderness. However, the first generation cephalosporins (e.g., cephalexin (e.g., Keflex®) tablets, cefadroxil (Duricef®) tablets, cefazolin (e.g., Ancef®) injectable, and also the third-generation injectable cephalosporin ceftriaxone* (Rocephin®) are excellent against the gram positive bacteria that commonly cause skin and wound infections. They are also reasonably effective against many of the bacteria that cause sinus, middle ear, and urinary tract infec-

* Though ceftriaxone is a "third generation" cephalosporin, it is still very effective against the gram positive bacteria that commonly cause infections. It can be effective when given just once or twice a day, making it ideal for wilderness medical kits.

tions. Cephalosporins are generally safe for women who might be pregnant. Many wilderness medical kits contain an inexpensive generic form of cephalexin, and ceftriaxone is a standard injectable antibiotic for wilderness ALS kits.

**Trimethoprim-sulfamethoxazole (e.g., Bactrim®, Septra®):** Bactrim® and Septra® are common trade names for a sulfa antibiotic and another antibiotic combined in a single pill (sulfamethoxazole and trimethoprim are the two antibiotics). (The combination is also known by the generic name co-trimoxazole in some English-speaking countries.) This combination is excellent against most of the gram-negative bacteria that cause UTIs, and good against most of the bacteria that cause otitis media. It is inexpensive. It is effective against some of the bacteria that cause diarrhea in travelers to developing countries (travelers' diarrhea). You can take trimethoprim-sulfamethoxasole to prevent diarrhea when in developing countries, but the risk of developing an allergy to sulfa or another adverse reaction makes bismuth subsalicylate (e.g., Pepto-Bismol®) tablets a better choice. Pregnant patients and patients allergic to sulfa should not take trimethoprim-sulfamethoxasole. Trimethoprim-sulfamethoxasole used to be a common wilderness medical kit antibiotic, but has mostly been replaced by ciprofloxacin (Cipro®), norfloxacin (Noroxin®), or ofloxacin (Floxin®).

**Metronidazole (e.g., Flagyl®):** like plain penicillin, metronidazole works well against anaerobic bacteria, including many of the bacteria in the colon for which penicillin is ineffective. Thus, though penicillin is the drug of choice for mouth infections, metronidazole is better for treating the anaerobic bacteria in abdominal infections (e.g., for treating appendicitis when on an expedition). Metronidazole is also the treatment of choice for diarrhea caused by Giardia. metronidazole should not be taken by a woman who might be pregnant. Those taking metronidazole must not drink alcohol; the result is violent and uncontrollable vomiting.

**Tetracycline and Doxycycline:** Tetracycline and doxycycline have similar uses: they are good for skin infections, some UTIs and some ear infections, and most travelers' diarrhea. They also have similar contraindications: they are NOT to be taken by pregnant women or children, because they deposit in forming bones and teeth. Tetracycline is very cheap, but must be taken four times a day, and because food or milk markedly decrease absorption, must be taken more than two hours after food and more than an hour before food. (This leaves only a hour or so in which to eat each meal.) Doxycycline, though more expensive, only has to be taken twice a day, and is not affected by food.

**Bismuth Subsalicylate (e.g., Pepto-Bismol®):** Bismuth subsalicylate is a pinkish liquid, also available in pills, that coats the stomach and intestine. It slows diarrhea, and it is excellent for preventing travelers' diarrhea. The usual dose is two tablets four times a day. Bismuth subsalicylate turns the stool black and may give the tongue a dark coating. Bismuth subsalicylate contains salicylate, which is a major component of aspirin. People should avoid bismuth subsalicylate in the same situations in which they should avoid aspirin (chicken pox, aspirin allergy, or bleeding problems).

**Ciprofloxacin (Cipro®):** is a very broad spectrum oral antibiotic. Ciprofloxacin is useful for most infections of the skin and the urinary and respiratory tracts. It is recommended for travelers' diarrhea. Ciprofloxacin does not cross react with penicillin or the sulfa drugs, and therefore can be used by patients with allergies to these antibiotics. Ciprofloxacin should not be used by those under 18 or by pregnant women. Despite its expense, its wide variety of uses makes it probably the most popular wilderness medical kit antibiotic. Similar antibiotics called norfloxacin (Noroxin®) and ofloxacin (Floxin®) are sometimes used instead.*

### Topical Agents

**Povadone-iodine (e.g, Betadine®):** povadone-iodine is antibacterial, antifungal, and antiviral, because of the iodine it contains. Though iodine is toxic to human tissue, the povadone buffers

the iodine, making it less toxic. Uses for povadone-iodine solution are discussed in the section on *Wilderness Surgical Problems.* Povadone-iodine ointment is useful to cover minor wounds (though bacitracin ointment is probably less irritating). It is available without a prescription.

**Bacitracin Ointment:** Bacitracin is an antibiotic that kills a great many bacteria, and rarely causes allergic reactions. It is the preferred ointment to place on minor wounds for antibacterial protection. It is available without a prescription.

**Silver Sulfadiazine Cream (e.g., Silvadene®):** Silver sulfadiazine is a combination of silver, which has strong antibacterial effects, with a sulfa antibiotic. So long as the person is not allergic to sulfa, it is the best covering for burns. (Bacitracin ointment is a good second choice). Silver sulfadiazine requires a prescription.

**Antifungal Creams:** miconazole nitrate (e.g., Micatin®, Monistat®) is an over-the-counter antifungal cream that is very effective against athletes' foot, jock itch, ringworm, and yeast vaginitis. **Monistat®** brand miconazole cream used to be prescription only, but is now available without a prescription. In late 1991, Monistat® was more expensive than the Micatin® brand. Other common antifungals include tolnaftate (e.g., Aftate®, Tinactin®) and clotrimazole (e.g., Lotrimin®).

## *Miscellaneous Medications*

**Acetazolamide (e.g., Diamox®):** Acetazolamide is a weak diuretic used for the treatment of glaucoma. Of interest to the mountaineer, however, it is an effective drug for preventing and treating the effects of altitude illness. The usual dose for preventing or treating altitude illness is 250 mg twice a day [5 mg/kg per day divided in two doses per 24 hours]. Acetazolamide is available in PO and in IV forms. To be effective for preventing altitude illness acetazolamide must be started at least 24 hours before ascent. Since acetazolamide is a sulfa drug, it should not be taken by patients with sulfa allergy.

**Nifedipine (e.g., Procardia®, Adalat®)** is an anti-hypertensive medication. In general, you should not aggressively treat hypertension in the field. However, extreme hypertension with signs of systemic compromise (including severe headache, chest pain, pulmonary edema, or stroke) can be cautiously treated with nifedipine. A 10 mg nifedipine capsule is chewed and swallowed. The patient's blood pressure should be followed carefully. An initial response should be seen within a half an hour with maximal response by two hours. Nifedipine is also used in the treatment of high altitude pulmonary edema; see the chapter on *Altitude Illness* for more about this. It can also be used for the treatment of angina if you don't have nitroglycerine.

**Anti-malarial drugs:** Anyone traveling to areas with a risk of malaria should take drugs for malaria prevention. The drug of choice in the past was chloroquine. Unfortunately, chloroquine-resistant malaria has been reported in most areas. You should get advice from the Center for Disease Control (404-639-1610) before going to areas with risk of malaria.

**Muscle Relaxants:** Muscle strains and the resulting spasm are common problems for wilderness travelers. Analgesics are helpful, but specific muscle relaxants are even more helpful for such problems. Benzodiazepines such as diazepam (e.g., Valium®) are very effective for muscle spasm, but are also very sedating. Cyclobenziprene (e.g., Flexeril®) is a moderately good muscle relaxant, though not quite as good as the benzodiazepines, but is only slightly to moderately sedating. It is not for pregnant patients

** These antibiotics are all members of the "quinolone" antibiotic family.

### *Sedation and Rapid Tranquilization:*

In the wilderness, an agitated, psychotic, or violent patient is an obvious safety risk to self and rescuers. If you can't calm the patient with verbal measures, rapid sedation or tranquilization can be a useful alternative.

Before starting sedation or rapid tranquilization, you must evaluate the patient for reversible causes of altered behavior, including hypoglycemia, hypothermia, and narcotic intoxication.

A wide variety of agents have been used for sedation including narcotics, benzodiazepines such as diazepam (e.g., Valium®) and barbiturates.

However, the high potency antipsychotic drugs (example: haloperidol, trade name Haldol®) have been shown to provide very rapid and safe tranquilization of agitated, psychotic, or violent patients. The high potency antipsychotics control behavior without treating the underlying problem. (When used for long periods, these drugs may also treat psychosis. However, that is not the effect that you are using when you use haloperidol to tranquilize a patient.)

You can give haloperidol (e.g., Haldol®) 2 to 5 mg PO or IM every 30-60 minutes until the patient is adequately sedated. Patients usually respond to 1-3 doses. Six doses per 24 hours is recommended as the maximum amount. The high potency antipsychotics tend not to cause respiratory depression or significant hypotension.

As with antinausea medication, the most significant side effects are the extrapyramidal symptoms involving abnormal muscle contractions of the neck or back, including dystonic reaction. Extrapyramidal symptoms are easily reversed with intravenous, intramuscular or PO diphenhydramine (e.g., Benadryl®).[22,23]

*A fairly uncommon serious reaction to the high potency antipsychotics is neuroleptic malignant syndrome. This syndrome is characterized by hyperthermia, hypertension and muscle rigidity. This syndrome tends to occur in patients treated with antipsychotic medications chronically and has not been reported with their use for rapid tranquilization. The neuroleptic malignant syndrome is a medical emergency requiring immediate evacuation and hospitalization.*

*If you need to tranquilize a patient and you only have over-the-counter medications, diphenhydramine (e.g., Benadryl®) is your best choice. A single dose of 50-100 mg (2-4 tablets) will mildly to moderately sedate most adults.*

## Drugs, Wilderness Travel, and Rescue

Many drugs interfere with judgement and coordination. For some people and with some drugs, the sedation may be minimal. However, until a person has tried a particular drug, the amount of sedation is impossible to predict. And, the person may be sedated enough to interfere with reflexes and judgment, but not be aware of the impairment.

Common drugs that cause sedation include:

* antihistamines
* narcotic analgesics
* muscle relaxants
* anti-nausea drugs

Those on such drugs should not climb exposed pitches unbelayed, belay others or act in similar rescue positions, drive or fly a vehicle, or operate complex machinery.

## Further Reading

The pharmacology information in this section is new to most EMTs and paramedics, because it includes common over-the-counter and prescription oral medications. While it may be hard to absorb at a single sitting, we try to include relevant pharmacology comments throughout all other sections of the curriculum to make it easier for you.

We recommend you borrow or buy (and read) copies of books such as Auerbach,[5] Bezruchka,[11] Darvill,[6] Forgey,[7] Steele[8], and Wilkerson.[9] Reading through these texts will help solidify your understanding of wilderness pharmacology and common medical problems.

# Glossary

**Adrenal Cortex:** The outer part or "sheath" of the adrenal gland, as opposed to the "core" or adrenal medulla. The adrenal cortex secretes hormones including hydrocortisone.

**Adrenal Medulla:** The central part of the adrenal ("on-top-of-kidney") gland, that secretes hormones such as adrenaline (epinephrine).

**Anaerobes:** Anaerobic bacteria; bacteria that live without oxygen. In the human body, anaerobic bacteria are found primarily in the mouth and in the intestines.

**Analgesia:** Relief of pain.

**Analgesics:** Medications to decrease pain.

**Anticonvulsant:** A medication to help prevent seizures (convulsions).

**Beta-blocker:** A medication that blocks the beta adrenergic receptors: receptors that respond to epinephrine and related hormones by increasing heart rate and blood pressure, causing sweaty palms, and similar reactions. Thus, beta blockers are used to treat hypertension and to "rest" the heart after a myocardial infarction.

**Blood-brain Barrier:** Many medicines, if they appear in the blood, diffuse into tissues almost immediately. However, not as many medicines pass from the blood into the brain, suggesting that there is something lining the brain blood vessels that prevents substances from diffusing into the brain. This gives rise to the term "blood-brain barrier."

**Buffer:** Used in reference to reactive chemicals such as acids or iodine. To "buffer" is to chemically hold some of the acid or iodine in reserve. In this way, there a low concentration of the acid or iodine, but when this is used up, more is released from the buffer chemical.

**Cycloplegics:** Medicines that paralyze eye muscles and dilate the pupil.

**Diuretic:** A medication that causes an increased urine output.

**Endotracheal:** Through an endotracheal tube.

**Extrapyramidal Symptoms:** Abnormal muscle contractions of the back, neck, or face. Sometimes seen as a side effect of antipsychotic medicines such as haloperidol (e.g., Haldol®), or from antinausea medicines such as prochlorperazine (e.g., Compazine®). A dystonic reaction is one type of extrapyramidal symptom.

**GI Bleeding:** bleeding from the gastrointestinal tract. GI bleeding can come from ulcers in the stomach or duodenum, from gastritis (diffuse inflammation of the stomach), esophageal varices (dilated veins), or from a variety of problems with the large or small bowel.

**Glaucoma:** increased pressure of the fluid within the eye. Untreated, it can lead to blindness.

**H2 Blockers:** Block the effects of histamine on acid secretion in the stomach. Common H2 blockers, including ranitidine (Zantac®) and cimetidine (e.g., Tagamet®), are often prescribed for ulcer disease.

**Histamine:** The primary "middleman" in many allergic problems, e.g., hives (urticaria), hay fever, poison ivy, and allergic conjunctivitis.

**Hyperglycemia:** high blood sugar.

**IM:** Intramuscular

**IV:** Intravenous

**Jewelweed Plant:** A plant with characteritic yellow or orange blossoms and translucent stems that grows near stinging nettles. The sap of this plant is an effective antidote when rubbed on stinging nettle stings.

**Loading Dose:** A large dose of a drug, given at the beginning of a course of the drug, to rapidly build up therapeutic levels of the drug.

**Neuroleptic Malignant Syndrome:** Hyperthermia, hypertension, and muscle spasms. A rare complication of long-term use of drugs such as Haldol®.

**NSAID:** Non-Steroidal Anti-Inflammatory Drug, e.g., ibuprofen.

**Oblique:** Slanting, diagonal.

**Otitis Media:** Middle ear infection.

**Peristalsis:** The rhythmic contractions of the gastrointestinal tract that propel digesting food and fecal matter along their course from one end to the other.

**Pharyngitis:** Sore throat.

**Platelets:** Small blood cells that are responsible for the initial plugging of leaks, which they do by sticking to the damaged edges of the blood vessels and each other. Platelets are implicated in strokes and myocardial infarctions.

**PO:** By mouth (per os).

**PR:** Rectally (per rectum).

**Sedation:** Sleepiness.

**SL:** Under the tongue (sublingual).

**SQ:** Subcutaneous.

**SubQ:** Subcutaneous.

**Tinnitus:** Ringing in the ears. Seen as a toxic effect of high doses of aspirin, or from ear infections or blows to the head.

**Titrate:** To administer a medication in increments until a desired effect occurs, e.g., giving morphine until the patient has pain relief.

**Transcutaneous:** Through the skin.

**Urticaria:** Hives; generalized wheals. Often a result of allergy.

**UTI:** Urinary Tract Infection (cystitis or pyelonephritis).

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**Table 1: A Personal Wilderness Medical Kit**

| Medication | Strength | # | Comments |
|---|---|---|---|
| ANALGESICS | | | |
| Acetaminophen (Tylenol®) | 325 mg | 50 | Mild analgesic. Controls fever. Unlike aspirin or ibuprofen, does not irritate stomach or cause ulcers, but also unlike them, has no significant anti-inflammatory effects. Safe for pregnant women. Usual adult dosage: 2 (650 mg.) every 4 hrs. (10 mg./kg. every 4 hours for children). Toxic if taken in more than recommended dosage. |
| Aspirin | 325 mg | 50 | Mild analgesic, anti-inflammatory. Usual adult dosage 2 (650 mg.) every 4 hours. May cause stomach upset or bleeding. Should be taken with food or antacids. Not for pregnant women. |
| Ibuprofen (e.g., Advil®, Nuprin®, Motrin®) | 200 mg | 50 | Mild-moderate analgesic, anti-inflammatory. Usual adult dosage for pain 400-600 mg every 4 hours; 800 mg three times a day for anti-inflammatory effect. May cause stomach upset or bleeding. Should be taken with food or antacids. |
| Ketorolac* (Toradol®) | 30 mg | 15 | Moderate-strong analgesic. Initial loading dose 30-60 mg IM, followed by half the loading dose (i.e., 15-30 mg) IM every 6 hours as needed for pain. Not for children or pregnant females. Precautions similar to ibuprofen. |
| Acetaminophen with codeine* (e.g., Tylenol #3®) OR: | 325 mg acetaminophen, 30 mg codeine | 25 | Narcotic analgesic. Controls moderate pain. Usual adult dosage: 1 or 2 tablets every 4 hours for pain relief. May cause drowsiness, constipation. |
| Acetaminophen with hydrocodone* (e.g., Vicodin®, Anexsia 5®) | 500 mg acetaminophen, 5 mg hydrocodone | 25 | Narcotic analgesic. Indications and precautions similar to acetaminophen with codeine; may cause less GI upset and less sedation. |
| Oil of Cloves (Eugenol) | | 1 btl | Topical dental analgesic. Applied to painful tooth as needed for pain. Provides temporary relief. |
| Phenazopyridine (e.g., Pyridium®)* | 200 mg | 10 | Analgesic for the urinary tract. One tablet four times a day for symptomatic relief of UTI pain. |
| ANTIHISTAMINES | | | |
| Diphenhydramine (e.g., Benadryl®) OR: | 25 mg | 20 | Antihistamines. Used for the relief of upper airway congestion due to allergy or infection. May reduce rash. |
| Chlorpheniramine (e.g., Chlor-Trimeton®), timed release | 12 mg | 8 | |

| Medication | Strength | # | Comments |
|---|---|---|---|
| Terfenadine* (Seldane®) OR: | 60 mg | 20 | Antihistamines. Similar to Benadryl although is associated with less drowsiness. Adult dosage of Seldane is 1 tablet twice a day. Hismanal is taken, 1 tablet per day. Expensive. **Do not take more than recommended dosage; do not take with erythromycin.** |
| Astemizole* (Hismanal®) | 10 mg | 10 | |
| DECONGESTANTS | | | |
| Pseudoephedrine (e.g., Sudafed®), sustained release | 120 mg | 8 | Decongestant. Indicated for the relief of nasal congestion due to common cold or allergy. May assist in relief of ear pain caused by eustachian tube dysfunction. May cause an elevation of BP and therefore should not be used in patients with severe hypertension or severe heart disease. Adult dosage for pseudoephedrine 120 mg sustained-release is 1 tablet twice a day. (Note that antihistamines and various combination pills are now also sold under the Sudafed® brand name.) |
| Oxymetazoline nasal spray (e.g., Afrin®) | | 1 btl | Nasal decongestant. Indications similar to Sudafed, less problems with hypertension. Two sprays in each nostril, twice a day for a maximum of 5 days. |
| ADRENERGIC AGENTS | | | |
| Albuterol inhaler* (e.g., Proventil®, Ventolin®) | | 1 | Bronchodilator. Useful in treating bronchospasm induced by allergy. |
| Epinephrine* (adrenaline), Epi-Pen®, Anakit® | | 1 | Lifesaving in anaphylaxis induced by allergy. Useful in treating bronchospasm. |
| STEROIDS | | | |
| Prednisone* | 20 mg | 20 | Steroid, anti-inflammatory. Indicated for severe allergic reactions, including insect stings, poison ivy, asthma, etc. Begin with 2-3 tablets per day, reduce dosage by 1/2 tablet per day after 3 days. Prednisone may elevate blood sugar and reduce the patient's ability to fight infections. Long term use (more than 1 week) is generally not indicated in the field and requires special precautions on discontinuing the drug. |
| Triamcinolone cream (e.g., Kenalog 0.1%®*) | 15 gm tube | 1 | Steroid cream. Useful for allergic reactions on the skin. Apply twice a day. Do not use on the face. |

| Medication | Strength | # | Comments |
|---|---|---|---|
| ANTACIDS | | | |
| Antacid tablets | | 25 | Antacids may be used for relief of stomach discomfort associated with excess acid. Can take along with aspirin or ibuprofen. May cause diarrhea or constipation depending on type. |
| MOTION SICKNESS DRUGS | | | |
| Meclizine (e.g., Bonine®, Antivert®*) OR: | 25 mg | 25 | For motion sickness. Indicated for the relief of symptoms associated with motion sickness including nausea, vomiting, and dizziness. Adult meclizine dosage is 25 - 75 mg per day. Often causes significant drowsiness. Dramamine may be given 1-2 tablets every 6 hours. Transderm Scop is a disc that is applied to the skin that allows for the sustained release of its active ingredient, scopolamine. Disc should be used only in adults and not in the elderly. A new patch is applied every 3 days. May cause dry mouth, blurred vision and infrequently restlessness and hallucinations. All of the drugs in this category work best if taken before the onset of symptoms. |
| Dimenhydrinate (e.g., Dramamine®) | 50 mg | 25 | |
| Scopolamine (Transderm Scop®*) patches | | 4 | |
| ANTI-MOTILITY DRUGS | | | |
| Loperamide (Imodium®**) | 2 mg | 10 | Antidiarrheal. Provides symptomatic relief of diarrhea. Does not treat the underlying cause of the diarrhea. Should not be used with diarrhea associated with bloody stools or fever. Adult dosage is 2 capsules followed by 1 capsule after each loose bowel movement, maximum 8 capsules per day. |
| ANTINAUSEA DRUGS | | | |
| Prochlorperazine (e.g., Compazine®*) | 10 mg | 10 | Antinausea and vomiting. Provides symptomatic relief of nausea and vomiting. For use in adults only, 1 tablet 3-4 times a day. A suppository form exists, but it may melt in a warm environment. May cause extrapyramidal symptoms including restlessness, involuntary movements, and extreme eye deviations. These reactions are treated with diphenhydramine (e.g., Benadryl®). |
| EYE MEDICATIONS | | | |
| Tetracaine ophthalmic solution* | | 1 btl | Topical anesthetic for the eye. Placing 2 drops in the affected eye allows easier examination and removal of foreign bodies. For temporary use only. |
| Cyclopentolate (e.g., Cyclogyl®*) | | 1 btl | Cycloplegic (dilates pupil). Reduces eye pain caused by pupillary spasm from abrasions or snowblindness. Will cause blurred vision. |

| Medication | Strength | # | Comments |
|---|---|---|---|
| Sulfacetamide ophthalmic drops* | | 1 btl | Antibiotic for the eye. Used in treating eye infections. |
| ANTIMICROBIALS | | | |
| Bismuth subsalicylate (Pepto-Bismol®) | | 50 | Antidiarrheal. Provides relief from diarrhea and may be taken prophylactically to prevent diarrhea. Contains aspirin, turns stools black. |
| Amoxicillin-Clavulanate* (Augmentin®) OR: | 250 mg | 15 | Antibiotic. Broad spectrum antibiotic useful for respiratory, skin, and urinary tract infections. Also good for animal and human bites. Dosage, 1 tablet, three times a day. Often causes diarrhea. Do not use with history of penicillin allergy. Expensive. |
| Ciprofloxacin* (Cipro®) | 500 mg | 20 | Broad spectrum antibiotic for respiratory, urinary tract, skin, and bone infections, and for travelers' diarrhea. Adult dosage 500 mg twice a day. For severe infections, 750 mg twice a day. Not for those under 18 or pregnant women. No cross-allergy with penicillin or sulfa antibiotics. Expensive. |
| Erythromycin* | 250 mg | 25 | Antibiotic. Good for respiratory infections and skin infections. Usual adult dosage 1 or 2 four times a day. Pediatric dosage 40 mg/kg four times a day. Take with food to avoid stomach upset. **Do not take with terfenadine (Seldane) or astemizole (Hismanal)** |
| Trimethoprim-Sulfamethoxasole* (e.g., Bactrim®, Septra®) OR: | | 15 | Antibiotic. A sulfa containing drug. Good for some respiratory infections and diarrhea. Adult dosage 1 tablet twice a day. Inexpensive compared with doxycycline. |
| Doxycycline* | 100 mg | 15 | Antibiotic. Indications and dosage similar to Bactrim. Not a sulfa drug. Not for children or pregnant women. |
| Metronidazole (e.g., Flagyl®) | 500 mg | 15 | Antibiotic, antiparasitic. Useful in treating diarrhea caused by protozoa (Giardia). Dosage is 1 or 2 tablets 3 times a day. May also be helpful for intra-abdominal infections. Not for pregnant women. |
| Please note that this is not an all inclusive list. Many other useful drugs exist and could be considered with respect to individual preferences. On the other hand, every drug on this list would not be carried by every WEMT on all trips. Many of the drugs have overlapping indications and uses. The development and use of a personal Wilderness Medical Kit should be done only in consultation with a family or medical command physician. | | | |
| *=prescription drug **=prescription drug, but a nonprescription form exists | | | |

**Table 2: Drugs for Wilderness EMS**

The choice of drugs depends on the patient population, the medications carried in members' personal wilderness medical kits, and the preference of the operational medical director. Some items may be kept on standby for airlift in as needed, or added to the kit based on knowledge of a specific victim's medical problems. Examples include insulin, antivenin, and specific anticonvulsants.

- albuterol inhaler
- aminophylline (IV)
- atropine (IV)
- bretylium tosylate (IV) (This is the only antiarrhythmic thought to be effective in hypothermic patients)
- cephalosporin antibiotic (IV or IM) (ceftriaxone is an excellent choice)
- dexamethasone (IV and PO)
- dextrose solution 50% (IV)
- diazepam or lorazepam (IV and PO)
- diphenhydramine (IV and PO)
- dopamine or dobutamine (IV)
- epinephrine (IV or SQ) (for weight reasons, only carry 1:1000)
- furosemide (IV and PO)
- glucagon (IV)
- hypertonic saline (IV)
- haloperidol (IM and PO)
- ketorolac (IM)
- lidocaine (IV, can be used as local anaesthetic)
- mannitol (IV)
- metronidazole (IV and PO)
- morphine sulfate or other potent narcotic (IV and SQ)
- naloxone (IV)
- oxytocin (IV)
- phenobarbital (IV and PO)
- phenytoin (IV and PO)
- propanolol (IV)
- sodium bicarbonate (IV and PO)

**Table 3: Drugs That May Freeze[12,13,14]**

- Albumin, normal human serum, 25%
- Albumin, normal human serum, 5%
- Al/Mg hydroxide (Mylanta II®)
- Aminophylline
- Calcium gluceptate
- Chlorpromazine HCl
- Cimetidine HCl
- Clindamycin phosphate
- Dexamethasone sodium phosphate
- Dextrose 10%, 3cc
- Dextrose 5%, 500cc (D5W)
- Diazepam
- Diphenhydramine HCl
- Dopamine HCl
- Ephedrine sulfate
- Epinephrine 1:1000
- Fentanyl citrate
- Furosemide
- Globulin, tetanus immune
- Heparin sodium
- Hexachlorophene detergent (PhisoHex®)
- Homatropine hydrobromide
- Hydralazine HCl
- Hydrocortisone cream 1%
- Hydroxyzine HCl
- Insulin, regular
- Isoproterenol HCl
- Lactated Ringer's solution 500cc
- Lidocaine 1% and 2%
- Lidocaine 1% and 2% with epinephrine
- Lidocaine HCl 20%
- Lidocaine viscous 2%
- Meperidine HCl (Demerol®) 100 mg/ml
- Morphine sulfate 10 mg/ml
- Morphine sulfate 15 mg/ml
- Naloxone HCl (Narcan®)
- Neomycin/gramicidin/polymixin oint. (Neosporin®)
- Pancuronium bromide (Pavulon®)
- Pentobarbital sodium
- Phenytoin sodium (Dilantin®)
- Potassium chloride
- Povadone-iodine solution (Betadine®)
- Prednisolone sodium phosphate
- Procainamide HCl
- Prochlorperazine edisylate
- Sodium chloride 0.9% (NS)
- Sodium chloride 0.45% (1/2 NS)
- Sterile water
- Succinyl choline
- Tetracaine HCl