



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

Wilderness EMT Lesson Plan

Part 14: Pharmacology

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Comments to:

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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 curriculum 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 Lesson Plan is one part of the ASRC-CEM Wilderness Emergency Medical Technician Curriculum. In concert with a textbook, the Curriculum 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 other sources. These include the Wilderness EMT program offered by SOLO (Stonehearth Open Learning Opportunities), the WEMT program developed by Wilderness Medical Associates for the National Association for Search and Rescue, 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 Curriculum. The National Association of EMS Physicians has published clinical guidelines for delayed/prolonged transport that apply to WEMTs.

With its prerequisites, this Curriculum complies with the Wilderness Prehospital Emergency Care curriculum established by the Wilderness Medical Society. 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.) The other prerequisite is certification to the Virginia Ground Search and Rescue Field Team

Member standards or equivalent. EMT standards are available from state EMS offices or the U.S. Department of Transportation. The Virginia GSAR standards 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 completed in roughly five intensive days. The curriculum also provides a checklist of recommended clinical training.

WEMT Lesson Plan 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 Project Coordinator actively supervises all aspects of curriculum development. Each Task Group provides references to support its statements and for further reading, and a glossary.

They also have been refined through seven pilot classes, several which have been held under the auspices of the Virginia Department of Emergency Services and Division of Emergency Medical Services. These agencies played a major part in development of the curriculum.

When the outline satisfies the Task Group, it goes to our **Editorial Board**. This Board includes officers of the ASRC and Center for Emergency Medicine, experts in emergency medicine, search and rescue, and education, and a State EMS director. Once it is acceptable to the Board, we release the Lesson Plan to the public.

Because we expect many good suggestions from the public, we are publishing these Lesson Plans, in a sense, as "drafts." We will distribute these individual Lesson Plans as widely as possible. After all Lesson Plans have had a year of public review, we will review and revise as appropriate, then issue a single comprehensive curriculum. We will continue to review and revise the curriculum regularly.

We actively solicit suggestions from anyone reading this. Please send your comments to the Task Group Leader as listed on the title page.

We are writing a textbook based on the material in the lesson plans. The Project Coordinator is the Editor-in-Chief, and works closely with Task Groups to consolidate and revise the material into a comprehensive textbook. All who have contributed to the curriculum will be acknowledged as contributors. The textbook will be submitted for publication in 1997.

XIV. Pharmacology

A. 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.

Notes: Pharmacology

This part of the curriculum 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 fa-

B. 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 curriculum.

C. Introduction

1. **Definition:** Pharmacology is the study of drugs and their effects on living organisms
2. **Cautions and Warnings:**
 - a. "The WEMT who treats himself has a fool for a patient."
 - b. this section very limited in scope; goal not to practice medicine "on the street," but for when regular medical care not available
 - c. may give drugs to others only by order of physician
 - (1) orders may be on scene, via radio, or via written standing orders
 - (2) actual drugs you use up to medical director and state regulations/laws
 - (a) e.g., in Pennsylvania: EMS regulation prohibits paramedics from giving medications other than on specified list
 - (b) ASRC-CEM *Wilderness Emergency Medicine Curriculum Development Project is working to establish another list for Wilderness EMS in the state*
 - (c) doctor may prescribe medications to carry in own medical kit, but may not legally use them to to treat others; applies to **non**prescription drugs, too; only exception if medical director's standing orders for oral medications
- d. EMT-Basics, too, must learn about pharmacology:
 - (1) may be on Field Team without radio communications, and member may ask you about medications in member's personal medical kit
 - (2) may want to build own personal medical kit from over-the-counter medications; with personal physician can add prescription medications: by treating own medical problems, can improve usefulness as Wilderness EMT
 - (3) patients may be on prescription medications; understanding basics of pharmacology and common oral medications may help in dealing with patients
3. **Drug Names:** most drugs have three names:
 - a. **Chemical Name**
 - (1) description of chemical structure
 - (2) only chemists interested
 - (3) rarely used in medical publications
 - b. **Generic Name**
 - (1) given to drug by company that first manufactures
 - (2) most often used in medical literature
 - c. **Trade Name**
 - (1) brand name given by a specific manufacturer
 - (2) can be recognized by registered symbol ® (or occasionally trademark symbol ™) after name
 - (3) drugs marketed by different manufacturers, so single drug may have different trade names
 - (4) trade name often more familiar than generic name, in part due to intensive advertising
 - (5) unfortunately, may not recognize drug by generic name if stocked in generic form in a medical drug kit

Example:

Chemical name: 7-[D-alpha-amino-

alpha-phenylacetamido]-3-methyl 3-
cephem-4-carboxylic acid monohy-
drate

Generic name: cephalexin

Trade names: Keflex®, Biocef®

d. **“Generic” drugs**

- (1) when first introduced, company has exclusive right to sell drug
- (2) to recoup research costs, price usually high
- (3) after several years, other companies may sell “generic” versions of drug, usually at lower price
- (4) “generics” often sold under generic name, but sometimes company may call by new trade name: original trade name of amoxicillin was Amoxil®; “generic” versions: generic amoxicillin, and other trade names such as Polymox®

D. Dosage and Administration

1. drugs administered by different routes:
 - a. **PO:** (per os) by mouth
 - b. **SQ or SubQ:** subcutaneous
 - c. **IM:** intramuscular
 - d. **IV:** intravenous
 - e. **SL:** (sublingual) under the tongue
 - f. **PR:** (per rectum) rectally
 - g. note that many drugs designed for PO, IM, or IV use may be given PR; may be particularly useful in wilderness; pills can be ground up and mixed with a small amount of binder (e.g., some food) and inserted in the rectum
 - h. **transcutaneous:** through the skin
 - i. **endotracheal:** through endotracheal tube
2. drugs can **interact:** two drugs can increase or decrease expected action of either drug or to increase toxic effects; examples:

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

b. **decreased response**

- (1) antacids (and food) decrease absorption of tetracycline
- (2) some drugs absorbed better on an empty stomach, some better with food
- c. **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.

3. **role of the host**

a. **children:**

- (1) children smaller than adults; adult dosages may be toxic for children
- (2) doses for children/infants generally based on body weight
- (3) recommended dosage based on known metabolic characteristics of child of given size: cannot necessarily cut adult dose in half for child half the size of an adult

b. **elderly:** may have

- (1) decreased excretion of drugs
- (2) increased sensitivity to mind-altering side effects

c. **pregnancy:**

- (1) ask female patients/team members about possibility of pregnancy before administering medications (if last normal menstrual period within 10 days, only small chance of pregnancy)
- (2) if pregnant, you are treating **two** patients, and fetus very susceptible to damage
- (3) for pregnant patient, avoid all drugs, if possible; a few “safe” drugs:

- (a) for pain, acetaminophen is safe (but not aspirin or ibuprofen)
- (b) for more severe pain, acetaminophen with codeine (e.g., Tylenol#3®), acetaminophen with hydrocodone (e.g., Vicodin®, Anexsia®, Lortabs®,) or other narcotics acceptable, but best avoided
- (c) antibiotics: penicillin, amoxicillin, ampicillin, erythromycin: generally safe in pregnancy; ciprofloxacin (Cipro®), norfloxacin (Noroxin®), ofloxacin (Floxin®), tetracyclines, and sulfa drugs (e.g., Bactrim® or Septra®) **not** safe
- (d) for “colds”: nasal decongestant sprays generally safe; oral antihistamines, though not generally thought to cause problems in pregnancy, are best avoided.

4. **existing conditions:**

- a. **altered absorption:** patient in shock may not absorb drugs given PO, IM, SubQ
- b. **altered metabolism:** patients with liver or kidney disease may develop toxicity from “usual” doses, because have harder time excreting drug
- c. **side effects:** epinephrine may precipitate chest pain or MI in patient with coronary artery disease

E. principles of drug treatment

- a. **indications:** reasons for using a specific drug:
 - (1) antihistamines {chlorpheniramine (e.g., Chlor-Trimeton®), diphenhydramine (e.g., Benadryl®), terfenadine (Seldane®), and astemizole (Hismanal®)} indicated for:
 - (a) allergy: allergic rhinitis/sinusitis, skin allergy including poison ivy
 - (b) infectious rhinitis (“colds”)

- (c) can also use over-the-counter antihistamines {diphenhydramine (e.g., Benadryl®), chlorpheniramine (e.g., Chlor-Trimeton®)} for sedation (prescription antihistamines terfenadine [Seldane®], and astemizole [Hismanal®] do not cross blood-brain barrier, therefore do not cause sedation)
- (2) erythromycin (antibiotic) indicated for:
 - (a) skin infections
 - (b) bacterial pharyngitis/otitis media in adults
 - (c) may be effective for some UTIs
- b. **contraindications:** reasons for not using a specific drug; some **relative** contraindications, others are **absolute** contraindications:
 - (1) tetracycline antibiotics almost absolutely contraindicated in children/pregnant women: become incorporated in growing bones and teeth, causing/weakness discoloration
 - (2) history of coronary artery disease is relative contraindication to epinephrine, but if patient with coronary disease dying of anaphylactic reaction, should give epinephrine anyway
 - (3) history of anaphylactic reaction to penicillin is absolute contraindication to ampicillin or amoxicillin (both penicillins); is relative contraindication to cephalosporin such as cephalexin (e.g., Keflex®) (10% cross-allergy between the penicillin and cephalosporin antibiotics)
- c. **adverse reactions**
 - (1) **side effects:**
 - (a) are undesired effects, often unavoidable
 - (b) examples:
 - i) most antihistamines have side effect of sedation

- ii) many antibiotics tend to predispose to yeast vaginitis
 - iii) all narcotics, including acetaminophen with codeine (e.g., Tylenol#3®) and acetaminophen with hydrocodone (e.g., Vicodin®, Anexsia®, Lortabs®), tend to cause constipation
- (2) **toxicity:** unwanted effects related to amount given; e.g., sedation and respiratory depression with large doses of codeine, hydrocodone, or morphine
- (3) **allergic reactions:**
- (a) based on sensitivity of patient to specific drugs
 - (b) range from mild rashes to anaphylactic reactions
 - (c) most drug allergies minor rashes, can be controlled with antihistamine
 - (d) allergy discussed further in *Wilderness Medical Problems*
- (4) **abuse:** nontherapeutic use (e.g., codeine or hydrocodone for euphoric effects instead of pain)
- d. **dosage**
- (1) must individualize dosage to patient and to problem
 - (2) **individual variation:**
 - (a) even given the effects of age, pregnancy, and pre-existing conditions, people vary in response to medications
 - (b) for example, smokers have increased enzymes in liver; this leads them to excrete certain drugs (e.g., aminophylline) faster than non-smokers
 - (c) 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 appropriate dosage: ringing in ears (tinnitus); pa-

tients on large doses told to cut down if develop tinnitus

(3) **loading doses**

- (a) if need effect of drug immediately, and drug effect is dependent on blood level, then is common to give loading dose to rapidly build up blood level
- (b) example:
 - i) if start taking 250 mg of amoxicillin three times a day for ear or sinus infection, will take 5-6 doses to build up to acceptable steady-state blood level
 - ii) if, however, take **two** 250 mg capsules to begin with, blood level rapidly climbs to appropriate level
 - iii) level then stays (nearly) constant as take 250 mg three times a day
- (c) may need to decrease amount taken each day if kidney failure, but loading dose still the same

F. Chronic Medications

1. if find lost person on medications for chronic problems, is it necessary to continue (or restart) the medication?
 - a. is complex question and best dealt with by a Wilderness Command Physician
 - b. command physicians not familiar with wilderness may refuse permission to give such medications
 - c. one cave rescue:
 - (1) person was uninjured but trapped for long time
 - (2) command physician (not a Wilderness Command Physician) did not allow EMTs at scene to administer the patient's regular anticonvulsant as prescribed by his regular doctor
 - (3) patient apparently had a seizure and died

- d. cannot provide guidelines for every chronic medication, will present common medications and the principles behind whether to reinstitute or not

2. Insulin

- a. if need injections of insulin and deprived of it, become hyperglycemic (high blood sugar), leading to increased urine output and marked dehydration*

b. Diabetics classed into Type I and Type II

- (1) *Type I {Juvenile-Onset Diabetes Mellitus, Insulin-Dependent Diabetes Mellitus (IDDM)}: has essentially no self-produced insulin: easily go into diabetic ketoacidosis ("DKA"):*

- (a) *occurs because insulin needed for blood sugar to enter cells*
 (b) *cells without glucose must subsist on fat, and produce ketoacids*
 (c) *may be fatal within few days*

- (2) *Type II {Non-Insulin-Dependent Diabetes Mellitus (NIDDM), Adult-Onset Diabetes Mellitus}:*

- (3) *still have some insulin production of own, generally enough to prevent ketoacidosis*

- (a) *however, Type II diabetics without insulin still may suffer from hyperglycemia and dehydration*
 (b) *hyperglycemia may become so severe that patient develops Hyperosmolar Nonketotic Coma simply from osmotic effects of high blood glucose*

- c. insulin does not keep long without refrigeration**¹; will seldom have in wilderness medical kit, unless searching for or rescuing diabetic

- (1) hydration more important than insulin for most diabetics with low insuling levels

- (2) even if have blood glucose sticks ("dextrosticks") and can monitor blood sugar levels, and have insulin, no hurry to tightly control blood glucose

- (3) if have insulin, give only small amounts (e.g., 5 units IV/hour) to keep glucose going into cells; will keep patient out of ketoacidosis; wait until later for fine-tuning of blood sugar, in more controlled environment

3. Antihypertensives

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

- b. exception would be if on beta-blocker {propranolol (e.g., Inderal®), atenolol (e.g., Tenormin®), metoprolol (e.g., Lopressor®)}: well-known to cause severe "rebound" hypertension when stopped abruptly; if without beta-blocker for day or two, **and** diastolic BP above 110, beta-blocker such as propranolol (e.g., Inderal®) should generally be reinstated immediately

4. Anticonvulsants

- a. Appalachian Search and Rescue Conference statistics: disproportionately number of lost people epileptics on anticonvulsant medications; reason not clear; may find trapped patient, or long evacuation, and without anticonvulsant medication for hours or days

- b. common anticonvulsants {phenytoin (Dilantin®), phenobarbital, carbamazepine (Tegretol®)}

* when blood glucose levels higher than certain level, glucose comes out in urine; since kidney can only concentrate urine a certain amount, kidney loses water with glucose, even if person is dehydrated and kidney is trying to hold onto water

** 30 days

- (1) have few acute side effects or toxicity when given orally
- (2) providing doses to wilderness patient makes sense
- (3) phenobarbital and to lesser extent phenytoin (Dilantin®) may cause mild sedation
 - (a) thus might be theoretically contraindicated after head injury
 - (b) however, standard treatment for head injuries is to administer phenytoin (Dilantin®) or phenobarbital to prevent seizures, so head injury **not** contraindication

c. anticonvulsants have long half-life

- (1) if patient off medicine for long time, may take many days of “regular” dose to get back to therapeutic blood
- (2) simply starting back on normal dose unlikely to do much to prevent seizures during rescue or evacuation: give **loading dose**
- (3) example:
 - (a) phenytoin (Dilantin®):
 - i) standard dose of phenytoin (Dilantin®) is 300 mg once daily, or 100 mg three times a day
 - ii) if adult without phenytoin for several days or who has never been on it, however, loading dose for 70 kg (150 lb) adult is 1200 mg, given in several doses an hour apart (e.g., 300 mg every hour for four hours)
 - (b) for phenobarbital, loading dose is roughly 180 mg, even though normal dose 30 mg three times a day

5. Psychiatric Medications

- a. many SAR subjects have chronic psychiatric problems and may be on psychiatric medications
 - (1) in general, none need to be restarted

- (2) if violent or combative, may give haloperidol (Haldol®) 1 to 5 mg, either PO or IM
- (3) immediate goal is sedation, not correcting underlying psychiatric problem, can also use other sedatives if no haloperidol
- (4) dealing with psychotic patients discussed in *Principles of General Medicine*
- (5) sedation and tranquilization discussed below

G. Medical Kits

1. since prescription medications are prerogative of prescribing physician, kits vary; discussion will focus on two kinds of kits: Personal Wilderness Medical Kit, and Wilderness ALS Medical Kit
2. **Personal Wilderness Medical Kit**
 - a. contents of personal wilderness medical kit depends on:
 - (1) medical problems in group
 - (2) medical problems that common where group plans to travel (e.g., high altitude, tropical diseases)
 - (3) group’s level of medical training
 - (4) weight and size constraints
 - (5) environment (e.g., insulin and suppositories will not last long if hot)
 - (6) expected distance to medical facilities
 - (7) number of people in group
 - (8) length of trip
 - b. series of articles treats topic of personal medical kits;^{2,3,4} see also Auerbach’s *Medicine for the Outdoors*,⁵ Bezruchka’s *Pocket Doctor*,⁶ Darvill’s *Mountaineering Medicine*,⁷ Forgey’s *Wilderness Medicine*,⁸ Steele’s *Far from Help*,⁹ Wilkerson’s *Medicine for Mountaineering*,¹⁰ *Mountaineering First Aid*¹¹; sample personal wilder-

- ness medical kit, with comments: Table 1
3. **Wilderness ALS Medical Kit:** suggested wilderness rescue team ALS drug list: Table 2; *Immobilization, Packaging and Transportation presents list of recommended equipment for such kits*
 4. wilderness medical kits must withstand hard use
 - (1) many drugs carry cautions to “store at controlled room temperature”
 - (2) while should try to keep drugs away from extremes of heat and cold, sometimes cannot avoid freezing of liquid drugs
 - (3) following drugs known to be altered by freezing, and thus might want to avoid when choosing drugs for 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 (PredForte®); sodium bicarbonate injection
 - (4) Decadron® (dexamethasone) unsafe after freezing, but Decadron® Sodium Phosphate (dexamethasone phosphate), which is roughly equivalent, **is** safe after freezing
 - (5) drugs reported as safe after freezing and thawing: Table 3.^{12,13,14}
- (3) effective for mild pain, and will reduce fever
 - (4) 325 mg and 500 mg sizes
 - (5) usual adult dose: two 325 mg tablets (650 mg) every four hours as needed for pain or fever
 - (6) liquid form for children dosed on weight
 - (7) safety:
 - (a) safe in recommended dosages for short period
 - (b) deliberate or accidental overdose (for adult, 5 to 10 grams = 15-30 regular strength tablets, taken at once) will almost invariably result in irreversible liver failure 3 days later
 - (c) chronic use for years, may also cause kidney damage
- b. **Aspirin:** oldest analgesic
 - (1) relieves mild pain just like acetaminophen; dosage same
 - (2) not as toxic to liver as acetaminophen when taken in overdosage
 - (3) well-known for causing stomach upset when taken on empty stomach, and may cause ulcers if taken on regular basis
 - (4) in small doses (one/day or less), unlike acetaminophen, decreases platelet stickiness: mild “blood thinner”; widespread use to prevent strokes and heart attacks
 - (5) however, blood thinning effect also means aspirin not appropriate if possible bleeding problems: would not give to person with tenderness over spleen after a fall, or if sustained major head injury
 - (6) should avoid in chicken pox, aspirin allergy, gastritis or possible ulcer disease, reflux, or bleeding problems
 - c. **NSAIDs:** Non-Steroidal Anti-Inflammatory Drugs
 - (1) Ibuprofen, available in OTC 200 mg tablets (Advil®, Nuprin®, others): most well-known NSAID

H. Wilderness Medical Kit Drugs

1. **Analgesics/Antipyretics/NSAIDs:** analgesics subdivided into categories, each with specific uses and contraindications:
 - a. **Acetaminophen** (Tylenol®):
 - (1) also known by generic name “paracetamol” in some English-speaking countries
 - (2) most commonly used analgesic

- (a) also available in liquid form as Pedipren®
 - (b) original trade name was Motrin®
 - (2) NSAIDs somewhat stronger than acetaminophen or aspirin for mild/moderate pain (e.g., 2 OTC 200 mg ibuprofen tablets instead of 2 acetaminophen tablets)
 - (3) like aspirin and acetaminophen, help reduce fever
 - (4) in larger doses (e.g., ibuprofen 600 mg four times a day, or 800 mg three times a day), also have anti-inflammatory effect
 - (a) does not occur when taken in lower doses just for pain
 - (b) anti-inflammatory effect takes day or two to develop; used primarily for inflammatory problems such as rheumatoid arthritis
 - (c) some believe anti-inflammatory effect useful with significant sprain or other injury but others doubt
 - (5) like aspirin, NSAIDs known to cause stomach upset; long-term use may lead to ulcers or GI bleeding, especially in elderly sometimes elderly on NSAIDs develop massive bleeding without any previous signs or symptoms
 - (6) rarely causes renal failure, especially if patient with uncorrected hypovolemia or dehydration
 - (7) can use aspirin itself as NSAID if large enough doses (16-20 a day); however, may cause stomach upset; other NSAIDs generally preferred
 - (8) other prescription NSAIDs: piroxicam (Feldene®), naproxen (Naprosyn®), indomethacin (Indocin®), diflunisal (Dolobid®), sulindac (Clinoril®), diclofenac (Voltaren®)
 - (9) ketorolac tromethamine (Toradol®): potent NSAID recently (1990) available in U.S. for IM use; only IM NSAID available in U.S.
 - (a) like other NSAIDs, anti-inflammatory analgesic
 - (b) ketorolac 30 mg IM provides pain relief comparable to meperidine (Demerol®) 100 mg IM/morphine 12 mg IM, but oral form not significantly better than other NSAIDs
 - (c) unlike narcotics, causes little/no sedation, little/no respiratory depression, not addicting
 - (d) like other NSAIDs, however, long-term use can cause ulcers or contribute to kidney failure.
 - (e) ketorolac ideal for wilderness:
 - i) can give without masking neurological changes or compromising respirations
 - ii) some theoretical decrease in clotting from NSAIDs/ketorolac; but not reason to withhold unless uncontrollable bleeding^{15,16,17,18,19,20}
 - (f) ketorolac can replace (some) morphine in advanced wilderness medical kits; however, morphine still has advantages: in pulmonary edema, or when **do** want sedation
- d. Narcotics:**
- (1) have been around as long as aspirin (nobody knows how long)
 - (2) name “narcotic” suggests ability to induce sleep; however, main use is to counteract strong pain **without** inducing sleep
 - (3) difference between medical (pharmacologic) and legal definitions of narcotics:
 - (a) medical: morphine and chemically-related compounds that have similar effects
 - i) marked pain relief
 - ii) mild sedation
 - iii) constipation (or control of diarrhea)
 - iv) cough suppression
 - v) sometimes, euphoria

- (b) legal: at least in U.S., narcotics are drugs defined as “dangerous”
 - i) “legal narcotics” include dangerous and addicting non-narcotic drugs (cocaine)
 - ii) nearly-innocuous and non-addicting drugs (marijuana)
 - iii) definition excludes other dangerous and addicting drugs (tobacco and ethanol)
- (4) narcotics well-known for abuse potential
 - (a) euphoric effect and addictive potential led to large population dependent on them (but not nearly so large populations addicted to tobacco and alcohol)
 - (b) short-term use of high doses of narcotics in patient with severe pain does **not** cause danger of addiction
- (5) morphine is the “classic” narcotic; IV morphine standard other narcotics measured against; primary effects of morphine:
 - (a) strong analgesia
 - (b) sedation (leading to respiratory depression if used to excess)
 - (c) nausea and occasionally vomiting
 - (d) suppression of cough
 - (e) suppression of intestinal motility, leading to control of diarrhea (or perhaps to constipation)
- (6) with certain narcotics, one effect predominates over others; some narcotic derivatives chemically related to morphine yet have low addiction potential and thus not “legally” narcotics:
 - (a) diphenoxylate (e.g., Lomotil®) and loperamide (e.g., Imodium®) decrease intestinal motility, but have few other effects
 - (b) dextromethorphan (found in Robitussin®-DM cough syrup) suppresses cough but has few other narcotic effects
 - i) cough syrups too heavy for wilderness medical kits
 - ii) dextromethorphan 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
 - iii) prescription-only 30 mg sustained-release dextromethorphan tablets are available (Humibid-DM: Adams Laboratories, Ft. Worth, TX 76118)
- (7) most personal wilderness medical kits contain general-purpose oral narcotic (e.g., acetaminophen with codeine, or acetaminophen with hydrocodone): has all narcotic effects, used for many problems; most add diphenoxylate (e.g., Lomotil®) or loperamide (Imodium®) for diarrhea, though the codeine or hydrocodone will work
- (8) several contraindications to narcotic pain medication:
 - (a) **shock:**
 - i) cause vasodilation, which may worsen shock
 - ii) may mask some symptoms, making assessment more difficult; perhaps creating false sense of security about patient’s condition
 - (b) **head trauma:**
 - i) may decrease level of consciousness and thus make the patient’s neurological status seem worse
 - ii) may cause respiratory depression, increasing blood CO₂ levels, and thus causing vasodilation in the brain, with attendant increases in intracranial pressure (ICP); however, agitation from pain can cause increased ICP
 - (c) **chest trauma:**

- i) narcotic respiratory depression may diminish respirations when already has respiratory compromise from trauma
 - ii) however, patient with rib fractures will generally “splint” and not fully expand lung on injured side due to pain; over long evacuation may lead to atelectasis (collapse of small sections of lung) or pneumonia; pain medication thus mainstay of treatment for rib fractures
- (d) **abdominal trauma:** repeated abdominal exams key to diagnosis of surgical abdomen; narcotics may make patient who needs immediate surgery look like one who doesn’t (though can use naloxone (e.g., Narcan®) to reverse narcotic effect if necessary for surgeon’s exam); also some suggestion narcotics may worsen internal bleeding
- (e) these reasons for not treating pain not absolute; for prolonged transport of patient in severe pain, narcotics routine; however, to keep narcotics from causing problems for wilderness patients:
- i) obtain direct order from Wilderness Command Physician whenever possible
 - ii) monitor patient’s neurological status carefully
 - iii) monitor patient’s respiratory status carefully (respiratory depression may cause neurologic damage even without respiratory arrest)
 - iv) use 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 patient closely, until achieve relief of pain)
- (9) morphine available in pills (can also be used rectally) if don’t have IV, can also give IV form sublingually
- (10) transdermal patches with narcotic fentanyl available (Duragesic™); very light, may be carried in some wilderness medical kits; cannot reduce dosage by cutting into fractions as with Trans-Derm Scop™, can “mask” skin side of patch with adhesive tape, then tape in place
- e. **Local Anesthetics:**
- (1) **Oil of Cloves (Eugenol):** local anaesthetic/antiseptic used by dentists; applied to painful gum or painful fractured tooth, will often produce immediate, dramatic relief; can mix with zinc oxide powder for temporary filling for cracked tooth or lost filling
 - (2) **Phenazopyridine hydrochloride (Pyridium®):** when excreted in urine, makes it bright orange; local anesthetic; relieves bladder irritation/constant need to urinate caused by bladder infections
 - (3) **Sting-Eeze™:** over-the-counter mixture of local anaesthetics for insect bites and stings; “unit” first aid kits may contain similar mixture (Sting-Kill™) in disposable swabs; reasonably effective, but contain benzocaine: may cause allergy
 - (4) juice of Jewelweed plant, found in swampy areas along Eastern trails, effective for nettle stings and other bites and stings, but not for poison ivy²¹
 - (5) Pramoxine (Prax™): local anaesthetic cream not known to cause allergy/irritation; prescription-only; in near future, may be available OTC
2. **Antihistamines:**
- a. histamine is primary “middleman” in many allergic problems: hives (urticaria), hay fever, poison ivy, allergic conjunctivitis

b. antihistamines block “H1” (histamine #1) receptor responsible for effects of histamine; relieves itching/swelling from allergy

c. “H2 blockers”

- (1) block effects of histamine on acid secretion in stomach
- (2) prescribed for ulcer disease
- (3) examples: ranitidine (Zantac®) cimetidine (e.g., Tagamet®)
- (4) recently found effective for urticaria (hives) from allergy

d. **Non-Sedating Antihistamines - Terfenadine (Seldane®) and Astemizole (Hismanal®)**

- (1) new, prescription-only antihistamines
- (2) don’t cross blood-brain barrier; do not cause sedation
- (3) good when want antihistamine effect but must avoid drowsiness
- (4) not as strong as other (sedating) antihistamines such as diphenhydramine (e.g., Benadryl®); expensive; unlike diphenhydramine, don’t work as “sleeping pill” or for sedation
- (5) **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.**

e. **Over-the-Counter Antihistamines - diphenhydramine (e.g., Benadryl®), chlorpheniramine (e.g., Chlor-Trimeton®), others:**

- (1) OTC antihistamines cause sedation, diphenhydramine (e.g., Benadryl®) more than chlorpheniramine (e.g., Chlor-Trimeton®)
- (2) sustained-release chlorpheniramine has advantage (or disadvantage, depending on purpose for using) of last-

ing 12 hours compared to only 4-6 hours for diphenhydramine (e.g., Benadryl®)

3. Decongestants:

a. General:

- (1) nasal mucosa may swell from allergy, viral/bacterial infection, trauma
- (2) nasal congestion much worse when lying flat (increased venous pressure in nose)
- (3) treatments: elevating head (i.e., sleeping on two pillows), can use medications:
 - (a) antihistamines (described above) can give some relief, especially if from allergy
 - (b) however, main drugs are decongestants: oral decongestant, or nasal spray or drops
- (4) unlike antihistamines, decongestants related to epinephrine: increase pulse, blood pressure, may cause restlessness and sleeplessness
- (5) also like epinephrine, can use for asthma if no better medications
- (6) many cough and cold preparations combine antihistamine and decongestant, but for wilderness medical kits, separate antihistamine and decongestant gives more flexibility: can use diphenhydramine (e.g., Benadryl®) for sedation; can use pseudoephedrine (e.g., Sudafed®) for asthma
- (7) nasal sprays have advantage: no significant systemic symptoms, because not absorbed
- (8) however, nasal sprays lose effectiveness over a few days; users may even become addicted (addicted: requiring nasal spray to breathe at night, but no euphoric effect)

b. Oral Decongestants:

- (1) pseudoephedrine (e.g., Sudafed®) is most well-known

(2) original Sudafed® just pseudoephedrine; now variety of Sudafed® preparations, including antihistamines and combinations

(3) pseudoephedrine is available in OTC 30 mg pills (one every 6 hours), prescription-only 60 mg tablets (also one every 6 hours); can take two OTC tablets to get same effect as one prescription tablet

c. Nasal Sprays:

(1) oxymetazoline (e.g., Afrin®) nasal spray has replaced phenylephrine (e.g., Neosynephrine®) nasal spray in most wilderness medical kits: oxymetazoline lasts 12 hours compared with phenylephrine's 6 hours

(2) can now find many inexpensive generic forms of oxymetazoline spray

4. Adrenergic Agents: related to hormones of adrenal medulla, such as adrenaline (epinephrine)

a. Anaphylaxis kit including epinephrine:

(1) many wilderness travelers carry epinephrine (adrenaline) in injectable form; is only immediate treatment for anaphylaxis, and good treatment for asthma

(2) two kinds of epinephrine kit commercially available in U.S.:

(a) **Anakit™:** Tubex™ syringe ampule with 1cc of a 1:1000 solution of epinephrine in plastic syringe; pressing plunger injects half the Tubex™, then twisting handle permits injecting other half

(b) **Epi-Pen™:** auto-injector which injects epinephrine when press against skin

b. Inhaler:

(1) different inhaled adrenergic agents available for asthma and other bronchospasm

(2) albuterol (e.g., Proventil®, Ventolin®) most common

(3) quite effective for asthma; however, as with epinephrine, may cause hypertension, increased stress on heart leading to arrhythmias, angina, or myocardial infarction, especially if used to excess

5. Steroids: also known as corticosteroids, related to hydrocortisone (hormone produced by adrenal cortex)

a. in low doses, hydrocortisone is normal part of body's functioning

b. in higher doses, steroids have strong anti-inflammatory effect (different mechanism from NSAIDs)

c. no significant difference between various oral/IV/IM steroids, except takes large amount of prednisone to equal effects of dexamethasone or methylprednisolone

d. short-term use of steroids (week or two) has few side effects, however:

(1) can raise blood sugar

(2) can raise blood pressure by causing fluid retention

e. longer use may cause thinning of bones and skin, atrophy of the adrenal cortex

f. after long course of steroids, sudden withdrawal may not allow time for the adrenal cortex to "gear up" to produce own hydrocortisone; may result in severe illness/death

g. Oral/IV/IM Steroids:

(1) prednisone pills common in personal wilderness medical kits: for severe allergic reactions that don't respond to antihistamines (e.g., severe poison ivy)

(2) dexamethasone (e.g., Decadron®): pill or IV form; is treatment for high altitude cerebral edema (discussed in *Altitude Illness*)

(3) methylprednisolone (e.g., Solu-Medrol®), used in IV form, common wilderness ALS medication used for

- asthma, bronchospasm, spinal cord injury
- h. **Steroid Creams:** useful for poison ivy, mosquito bites, allergic rashes
- (1) many, many brands/types of steroid creams/ointments
 - (2) from OTC 1/2%-1% hydrocortisone cream (e.g., Cortaid®): very weak, but enough for minor allergic problems, to creams hundreds of times stronger
 - (3) none except strongest cause suppression of adrenal cortex
 - (4) brand names of moderately strong prescription-only creams commonly carried in wilderness medical kits include Kenalog®, Valisone®, Aristocort®, Benisone®, Diprosone®, Diprolene®, Topicort®, Lidex®, Topsy®[®], Westcort®
 - (5) never use strong steroid creams on face, except possibly for very short course for severe inflammation (blistering poison ivy): may cause ugly telangiectasias (permanently dilated blood vessels) and thinning of skin
 - (6) don't put steroids on infected wounds, since decrease ability to fight infection
6. **Antacids:** seldom lifesaving, but very useful for severe stomach hyperacidity or gastroesophageal reflux; single dose four times a day (an hour after every meal and at bedtime) also effective treatment for ulcers
7. **Motion-sickness Drugs:** work best when take before motion starts
- a. **Meclizine (e.g., Bonine®, Antivert®):**
 - (1) moderately effective for motion sickness
 - (2) available in OTC (Bonine®) and prescription (Antivert®) 25 mg tablets
 - (3) chewable tablets best because can take with minimal swallowing (important if already motion sickness); Bonine® is chewable; one form of Antivert® chewable
 - b. **Dimenhydrinate (Dramamine®):**
 - (1) available OTC for many years; similar to meclizine, also chewable form; both dimenhydrinate and meclizine may cause significant drowsiness
 - c. **Trans-Derm Scop:** (pronounced "transderm scope") patches:
 - (1) provide multi-day sustained release scopolamine: highly effective against space sickness per NASA
 - (2) to get loading dose of scopolamine into system quickly, patch's glue contains very high concentration of scopolamine: many cases of "blown pupils" due to getting glue on fingers then rubbing eye
 - (3) patches only come in one size; may be too much for small people or if very sensitive to it; can cut patch in half (or other fraction) and still effective
 - (4) side effects: dry mouth, blurred vision, nausea, lightheadedness, difficulty concentrating, urinary retention; elderly may have psychotic reactions
8. **Anti-nausea Drugs:**
- a. some drugs better for motion sickness (described above), others better for nausea and vomiting from other causes (e.g., viral gastroenteritis)
 - b. any anti-nausea drug may cause severe, debilitating side effect, **dystonic reaction***

* dystonic reaction is special, very severe, extrapyramidal symptom; other involuntary movements due to extrapyramidal motor system also possible

- (1) involuntary muscle spasms; may cause arching of the back, twisting of head from side to side, sometimes facial twitching, tongue-thrusting
- (2) not related to amount of drug
- (3) can't predict who will develop
- (4) can rapidly and effectively treat with oral or IM diphenhydramine (e.g., Benadryl®) (or any other antihistamine)

c. Prochlorperazine (e.g., Compazine®):

- (1) commonly prescribed for nausea and vomiting from gastroenteritis, pain
- (2) may cause mild sedation
- (3) available in pills, IM/IV injection, suppositories
- (4) normal adult dose 5-10 mg every 4-6 hours as needed

d. Other Antinausea Drugs:

- (1) Prescription-only: metoclopramide hydrochloride (e.g., Reglan®), trimethobenzamide hydrochloride (Tigan®), thiethylperazine maleate (Torecan®): similar to prochlorperazine (Compazine®)
- (2) OTC medications may be somewhat effective against nausea:
 - (a) antihistamines like diphenhydramine (e.g., Benadryl®) and chlorpheniramine (e.g., Chlor-Trimeton®)
 - (b) drugs for motion sickness (see above)

9. Anti-motility Drugs:

- a. loperamide hydrochloride (Imodium®) and diphenoxylate hydrochloride (e.g., Lomotil®): narcotic derivatives with few narcotic effects other than slowing peristalsis of intestines
- b. because of worries about possible abuse by narcotic addicts, diphenoxylate has small amount of atropine

added to each tablet; amount very small, causes no side effects at normal dosages

- c. generic form of diphenoxylate available, and is very inexpensive; small, hard pills: light and travel well
- d. loperamide (Imodium®) relatively expensive but, unlike diphenoxylate, available without prescription (Imodium® AD)
- e. can use any narcotic (e.g., codeine, hydrocodone) to control diarrhea, but must expect "side effects" of analgesia/sedation

10. Eye Medications

a. Eye Anaesthetics:

- (1) tetracaine/proparacaine drops anesthetize eye to allow eye exam
- (2) however, thought to interfere with healing if used on regular basis for pain control (though no good studies to show)
- (3) adequate anesthesia of eye is extremely helpful to evaluate painful eye, and for removing foreign bodies from eye

b. Pupil Dilators (Cycloplegics):

- (1) cyclopentolate (e.g., Cyclogyl®) used to dilate pupil
- (2) effect lasts roughly a day
- (3) doctors routinely use one/two drops for patients with corneal abrasions or snowblindness
- (4) relaxes spasm of eye that causes pain after such eye injuries
- (5) never use cyclopentolate narrow anterior chamber of eye: might cause severe glaucoma (see *Wilderness Medical Problems for more about this*)
- (6) other dilating drops sometimes found in wilderness medical kits include homatropine (long-acting: many days), and phenylephrine (e.g., Neosynephrine®) and tropicamide (shorter-acting)

c. Eye Antibiotics:

- (1) sulfacetamide: sulfa antibiotic commonly used as drops for suspected infectious conjunctivitis or as ointment when corneal abrasion patched
- (2) other antibiotics used in eye: gentamicin, tobramycin, and Neosporin®.
 - (a) Neosporin® is combination of three antibiotics: neomycin, polymyxin, and bacitracin; not recommended, because some develop allergy to neomycin
 - (b) Polysporin® contains just polymyxin and bacitracin; reasonable alternative
 - (c) plain bacitracin eye ointment also available, and good choice for wilderness medical kit
- d. **Cortisporin® Ointment:** combination of the three Neosporin® antibiotics and steroid

- (1) popular in wilderness medical kits with idea that, since contains so many drugs, putting it in the eye bound to do something useful
- (2) however, steroids placed in eye make viral and fungal infections much worse; standard medical recommendation is that only an ophthalmologist should prescribe steroid eye medications

e. Fluorescein Strips:

- (1) though can see many corneal abrasions with only shallow, oblique light of a penlight, much easier to see with drop of fluorescein solution in eye
- (2) abrasions take up stain and appear greenish
- (3) fluorescein fluoresces (glows) in UV light, thus its name; in ED, can use blue “cobalt filter” or UV light to see
- (4) helps abrasions even with a penlight or daylight
- (5) strips of filter paper coated with fluorescein available; can wet with sterile

anaesthetic solution or water and touch inner part of lower eyelid

- (6) dye is water soluble and non-staining, and no known side effects; normal tearing will wash dye away in an hour
- (7) best of all, few strips weigh virtually nothing

11. Antimicrobials:

- a. strictly speaking, “antibiotics”=chemicals synthesized by one microorganism for use against another: penicillin is chemical made by *Penicillium bread mold* to protect against bacteria
- b. “antimicrobial” also includes synthetic chemicals used to fight certain microorganisms
- c. almost everyone uses “antibiotics” to mean antimicrobials

d. Oral and IV/IM Antibiotics**(1) Penicillins**

- (a) **“Plain” penicillin (e.g., Pen-V-K®):**
 - i) the oldest known antibiotic
 - ii) effective against anaerobic bacteria found in mouth (e.g., for infected tooth or cheek)
 - iii) also good against strep throats, strep cellulitis
 - iv) However, many bacteria have defenses against it; not effective against gram-positive pus-forming bacteria such as Staph, gram-negative bacteria that cause ear infections and UTIs, or anaerobic bacteria found in the gut
 - v) is safe for pregnant women
 - vi) few carry plain penicillin

(b) Amoxicillin:

- i) modified form of penicillin
- ii) not as effective against mouth anaerobes but still fairly good
- iii) however, kills more gram negative bacteria; good for ear infections, UTIs

- iv) ampicillin is same but must be taken 4x/day compared with 3x/day for amoxicillin
 - v) safe for pregnant women
 - vi) if allergic to penicillin, must not take amoxicillin
 - vii) is very cheap
- (c) **Amoxicillin-clavulanate (Augmentin®):**
- i) is amoxicillin with another drug (clavulanate) that overcomes resistance to amoxicillin of many bacteria
 - ii) good for skin infections including mammal bites
 - iii) even better than amoxicillin for ear infections, respiratory infections, and UTIs
 - iv) new drug, very expensive
 - v) tends to cause diarrhea
 - vi) if allergic to penicillin, must not take amoxicillin-clavulanate
 - vii) popular drug for wilderness medical kits
- (2) **Erythromycin:**
- (a) common substitute for penicillin, amoxicillin, and amoxicillin-clavulanate (Augmentin®) if allergic to penicillin
 - (b) used for ear infections, skin infections, UTIs
 - (c) however, does not kill one gram negative organism (*H. Flu.*) that occasionally causes ear infections and UTIs, especially in children
 - (d) does, however, kill almost all organisms responsible for pneumonia in otherwise healthy people
 - (e) safe for pregnant women
- (f) may cause stomach upset, particularly if taken on empty stomach, so take with food
- (g) found in some wilderness medical kits
- (h) **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.**
- (3) **Cephalosporins:**
- (a) large family of antibiotics related to but different from penicillins
 - (b) about 10% of those allergic to penicillins allergic to cephalosporins and vice versa
 - (c) several “generations” of cephalosporins; newer (second and third generations) covering many “nasty” bugs found almost exclusively in debilitated people in hospitals; these newer drugs of little use for wilderness
 - (d) however, first generation cephalosporins such as cephalexin (e.g., Keflex®) tablets, cefadroxil (Duricef®) tablets, cefazolin (e.g., Ancef®) injectable, and also third-generation injectable cephalosporin ceftriaxone* (Rocephin®) excellent against gram positive bacteria that commonly cause skin and wound infections; also effective for sinus, middle ear, and urinary tract infections
 - (e) cephalosporins generally safe in pregnancy
 - (f) many wilderness medical kits contain inexpensive generic cephalexin; ceftriaxone is standard

* though a “third generation” cephalosporin, still very effective against gram positive bacteria that commonly cause infections; effective given just once or twice a day: ideal for wilderness medical kits

injectable antibiotic for wilderness ALS kits

(4) Trimethoprim-sulfamethoxazole (e.g., Bactrim®, Septra®):

- (a) combination of sulfa antibiotic and another antibiotic in single pill (sulfamethoxazole, trimethoprim) (known by generic name cotrimoxazole in some English-speaking countries)
- (b) excellent against most gram-negative bacteria causing UTIs; good against most bacteria causing otitis media
- (c) inexpensive
- (d) effective against some bacteria causing diarrhea in travelers to developing countries (travelers' diarrhea).
- (e) can take to prevent travelers' diarrhea, but risk of developing sulfa allergy or other adverse reaction makes bismuth subsalicylate (e.g., Pepto-Bismol®) tablets better choice
- (f) pregnant patients and those allergic to sulfa should not take
- (g) used to be common wilderness medical kit antibiotic, but mostly replaced by ciprofloxacin (Cipro®), norfloxacin (Noroxin®), or ofloxacin (Floxin®)

(5) Metronidazole (e.g., Flagyl®):

- (a) like plain penicillin, metronidazole works well against anaerobic bacteria, including many in the colon for which penicillin ineffective
- (b) though penicillin drug of choice for mouth infections, metronidazole better for anaerobic bacteria in abdominal infections (e.g., appendicitis)
- (c) also treatment of choice for Giardia diarrhea
- (d) should not be taken by woman who might be pregnant

- (e) must not drink alcohol while taking; causes violent and uncontrollable vomiting

(6) Tetracycline and Doxycycline:

- (a) have similar uses: skin infections, some UTIs, some ear infections, and most travelers' diarrhea
- (b) similar contraindications: NOT to be taken by pregnant women or children, because deposit in forming bones and teeth
- (c) tetracycline very cheap, but must be taken 4x/day; food/milk decrease absorption, so must take 2 hrs. after food and 1 hr before food; leaves only about 1 hour in which to eat each meal
- (d) doxycycline, though more expensive, only taken 2x/day, and not affected by food

(7) Bismuth Subsalsalicylate (e.g., Pepto-Bismol®):

- (a) a pinkish liquid, also pills: coats stomach and intestine
- (b) slows diarrhea
- (c) excellent for preventing travelers' diarrhea; dose: 2 tablets 4x/day
- (d) turns stool black, may give tongue dark coating
- (e) contains salicylate, major component of aspirin
- (f) should avoid in the same situations in which should avoid aspirin (chicken pox, aspirin allergy, gastritis or possible ulcer disease, reflux, or bleeding problems)

(8) Ciprofloxacin (Cipro®):

- (a) very broad spectrum oral antibiotic
- (b) useful for most infections of skin and urinary/respiratory tracts
- (c) recommended for the travelers' diarrhea
- (d) does not cross react with penicillin or sulfa drugs; can be used if allergic to either

- (e) should not be used in those under 18 or pregnant women
- (f) despite expense, wide variety of uses makes it most popular wilderness medical kit antibiotic
- (g) similar antibiotics norfloxacin (Noroxin®) and ofloxacin (Floxin®) sometimes used instead*

e. Topical Agents

- (1) **Povadone-iodine (e.g., Betadine®):**
 - (a) antibacterial, antifungal, antiviral, because of iodine it contains
 - (b) iodine toxic to tissue, but povadone buffers iodine, making it less toxic
 - (c) uses for solution discussed in *Wilderness Surgical Problems*
 - (d) ointment useful to cover minor wounds (though bacitracin ointment less irritating)
 - (e) available without prescription
- (2) **Bacitracin Ointment:**
 - (a) antibiotic that kills many bacteria
 - (b) rarely causes allergic reactions
 - (c) preferred ointment for minor wounds
 - (d) available without prescription
- (3) **Silver Sulfadiazine Cream (e.g., Silvadene®):**
 - (a) combination of silver (has strong antibacterial effect) with sulfa antibiotic
 - (b) so long as not allergic to sulfa, best covering for burns (bacitracin ointment good second choice)
 - (c) requires prescription
- (4) **Antifungal Creams:**
 - (a) miconazole nitrate (e.g., Micatin®, Monistat®): over-the-counter antifungal cream, very effective against athletes' foot, jock itch, ringworm, and yeast vaginitis

- (b) **Monistat®** brand miconazole cream used to be prescription only, but is now available in U.S. without a prescription
- (c) in late 1991, Monistat® more expensive than Micatin® brand
- (d) other common antifungals: tolnaftate (e.g., Aftate®, Tinactin®), clotrimazole (e.g., Lotrimin®)

12. Miscellaneous Medications

a. Acetazolamide (e.g., Diamox®):

- (a) weak diuretic used for the treatment of glaucoma
- (b) effective for preventing and treating altitude illness
- (c) usual dose is 250 mg twice a day [5 mg/kg per day divided in two doses per 24 hours]
- (d) available in PO and IV forms
- (e) for preventing altitude illness, must start 24 hours before ascent
- (f) since a sulfa drug, not to be taken if allergic to sulfa

b. Nifedipine (e.g., Procardia®, Adalat®):

- (1) nifedipine useful for hypertension
 - (a) in general, should not aggressively treat hypertension in the field
 - (b) however, if extreme hypertension with systemic signs (severe headache, chest pain, pulmonary edema, or stroke) can treat cautiously with nifedipine: 10 mg nifedipine capsule chewed and swallowed; blood pressure followed carefully; initial response within 1/2 hour with maximal response by 2 hours
- (2) also useful in treatment of high altitude pulmonary edema (discussed further in *Altitude Illness*)

* these antibiotics all members of "quinolone" family

- (3) can also be used in treatment of angina if don't have nitroglycerine
- c. Anti-malarial drugs:**
- (1) those traveling to areas with risk of malaria should take drugs for malaria prevention
 - (2) drug of choice in past was chloroquine; unfortunately, chloroquine-resistant malaria now in most malaria-prone areas
 - (3) get advice from Center for Disease Control (404-639-1610) before going
- d. Muscle Relaxants**
- (1) muscle strains and resulting spasm common in wilderness
 - (2) analgesics helpful
 - (3) specific muscle relaxants helpful
 - (4) can use benzodiazepines such as diazepam (e.g., Valium®): very effective but also very sedating
 - (5) cyclobenziprene (e.g., Flexeril®):
 - (a) moderately good muscle relaxant
 - (b) slightly to moderately sedating
 - (c) not for pregnant patients
- e. Sedation and Rapid Tranquilization**
- (1) agitated, psychotic, or violent patient safety risk to self and rescuers; if can't calm the patient with verbal measures, can use rapid sedation or tranquilization
 - (2) before starting sedation or rapid tranquilization, must evaluate patient for reversible causes of altered behavior: hypoglycemia, hypothermia, narcotic intoxication, others
 - (3) wide variety of agents used for sedation including narcotics, benzodiazepines such as diazepam (e.g., Valium®), barbiturates
 - (a) high potency antipsychotic drugs (example: haloperidol, trade name Haldol®) provide rapid and safe tranquilization of agitated, psychotic, or violent patients
 - (b) high potency antipsychotics control behavior without treating underlying problem (used for long periods, also treat psychosis; however, that not effect use haloperidol to tranquilize patient)
 - (c) can give haloperidol (e.g., Haldol®) 2 to 5 mg PO or IM every 30-60 minutes until the patient is adequately sedated; usually respond to 1-3 doses; 6 doses per 24 hours recommended maximum
 - (d) high potency antipsychotics respiratory don't cause respiratory depression or significant hypotension
 - (e) as with anti-nausea medicines, most significant side effects are extrapyramidal symptoms, including dystonic reactions: abnormal muscle contractions of neck or back; easily reversed with intravenous, intramuscular or PO diphenhydramine (e.g., Benadryl®)^{22,23}
 - (f) *uncommon serious reaction to the high potency antipsychotics: neuroleptic malignant syndrome: hyperthermia, hypertension and muscle rigidity; tends to occur in patients treated with antipsychotic medications chronically, not reported with rapid tranquilization; is a medical emergency requiring immediate evacuation and hospitalization*
 - (4) if need to tranquilize patient and have only OTC medications, diphenhydramine (e.g., Benadryl®) is best choice; single dose of 50-100 mg (2-4 tablets) will mildly to moderately sedate most adults

I. Drugs, Wilderness Travel, and Rescue

1. many drugs interfere with judgement and coordination
2. those on such drugs should not climb exposed pitches unbelayed, belay others or act in similar responsible rescue

positions, drive or fly a vehicle, or operate complex machinery

3. common drugs that cause sedation:
 - a. antihistamines
 - b. narcotic analgesics
 - c. muscle relaxants
 - d. anti-nausea drugs

J. Further Reading

1. pharmacology information in this section new to most EMTs and paramedics, because includes common OTC and prescription oral medications; may be hard to absorb at single sitting, so include relevant pharmacology comments throughout all other sections of the curriculum to make it easier to learn
2. recommend you borrow or buy (and read) copies of books such as Auerbach,⁵ Bezruchka,⁶ Darvill,⁷ Forgey,⁸ Steele⁹, and Wilkerson;¹⁰ will help solidify 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 anti-nausea 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 characteristic 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.

Medication	Strength	#	Comments
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	
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.

Medication	Strength	#	Comments
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.
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.

Medication	Strength	#	Comments
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.
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_)

Medication	Strength	#	Comments
Trimethoprim-Sulfamethoxazole* (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 anesthetic)
- 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)
- propranolol (IV)

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 (Phiso-Hex®)
- 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
- Povidone-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