Wilderness EMS Institute

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

Wilderness EMT Lesson Plan

Part III: Patient Assessment

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Verbose Outlines

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

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

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

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

Splitting the Outlines

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

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

On to a Textbook

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

Notes: *Patient Assessment*

To effectively manage the victim of illness or injury, you must first determine the scope and nature of the problem. This is challenging to the physician in the hectic but still controlled environment of the Emergency Department, but you must contend with the additional pressures of a potentially hostile environment, limited resources and personnel, and until now, limited training. EMT training stresses rapid assessment of life threatening problems followed by stabilization and prompt transportation to a medical facility. WEMTs face rescues taking hours or even days. As such, you will have to manage chronic as well as acute problems. The body is complex; the spectrum of injury and illness goes far beyond a rote secondary survey. As with medical students, you must learn the general principles of taking a history and performing a physical exam. You may also have to care for members of the search and rescue team. To care for them, you also need more than you can get from a brief primary and secondary survey. The fundamentals of taking a history and conducting a physical exam will be reviewed, with an emphasis placed upon performing a directed physical exam.

The "street" EMT can usually bank on an ED doctor re-examining the patient in a few minutes. Faced with a long evacuation, you will have ample time to suffer the consequences of any injury or illness missed during the history and physical. We hope that, by teaching you some of the principles of medicine, you will be able to handle, with reasonable grace and style, and with a good outcome for the patient, situations not covered in your EMT or WEMT training.

Lecture format is unsuited for teaching history and physicals (H&Ps). We expect this section's lecture time to be brief (2 hours). There should be plenty of time for small-group practical stations including assessment (3 hours, not including several integrated field scenarios).

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

III. Patient Assessment

A. Educational Objectives

1. Demonstrate the ability to apply knowledge of EMT primary survey principles in wilderness situations, including:
   a. discussing wilderness hazards to patient and rescuer;
   b. proper positioning of the patient to maintain the airway, while protecting the cervical spine, even if the patient is in a litter;
   c. use of improvised materials to splint a flail chest;
   d. indications for a chest tube or chest decompression in the wilderness;
   e. appropriate methods of hemorrhage control, including the use of a tourniquet in the wilderness; and
   f. other wilderness management priorities that must be dealt with concurrent with the primary survey.
2. Explain the following principles as applied to taking a history and performing a physical exam:
   a. directed versus complete screening exams;
   b. proper order and components of a history and physical; and
   c. general techniques for approaching a wilderness patient, including:
      (1) developing rapport;
      (2) guiding the history;
      (3) keeping the patient informed of your exam; and
      (4) completeness.
3. Identify each of the following elements of a wilderness history, and give an example of each:

a. Chief Complaint, including five important qualifications of a painful chief complaint;
b. History of Present Illness;
c. Past Medical History, including five major components;
d. Review of Systems; and
e. directed questioning.

4. Identify the four modes of physical examination, and give major examples of each in physical diagnosis.
5. Explain how to check for orthostasis and how to interpret the results.
6. Demonstrate a general screening physical exam for a patient who just suffered minor trauma.
7. Demonstrate the ability to perform detailed physical exams of the following, and properly report the results:
   a. General appearance;
   b. Skin;
   c. Rashes;
   d. Head;
   e. Ears;
   f. Eyes;
   g. Nose;
   h. Mouth;
   i. Neck;
   j. Lungs;
   k. Heart;
   l. Back;
   m. Abdomen;
   n. Genital/Rectal; and
   o. Neurological exam, including
      (1) Mental Status:
         (a) Alertness,
         (b) Orientation,
         (c) Cognition and Memory, and
         (d) Affect (mood);
      (2) Cranial Nerves,
      (3) Sensory,
      (4) Motor,
      (5) Deep Tendon Reflexes (DTRs) and Babinski response, and
      (6) Cerebellar (and possibly Gait.)
8. Demonstrate the ability to interpret simple neurological exam results in terms of common acute neurological problems.
9. Identify the temperature measurement needs of the WEMT, and identify important characteristics of the following places temperature may be measured:
   a. the skin;
   b. the mouth;
   c. the rectum;
   d. the axilla (armpit);
   e. the tympanic membrane (eardrum); and
   f. or the esophagus.
10. Identify important characteristics of different types of thermometers, including:
   a. glass thermometers;
   b. disposable paper thermometers for forehead and oral use;
   c. infrared tympanic thermometers; and
   d. continuous-reading electronic temperature monitors, including improvisation from inexpensive non-clinical thermometers.
11. Identify the importance and wilderness application of the following monitoring devices:
   a. EKG monitors;
   b. BP cuffs;
   c. pulse monitors;
   d. pulse oximeters;
   e. expired CO_2 monitors; and
   f. Foley catheters or Texas catheters.

B. Wilderness EMT Primary Survey

1. This is a review of very basic material. To what you already know about the primary survey, it will introduce some new wilderness-related twists.

2. Your first responsibility, even before assessing the patient, is to look for wilderness **hazards**, such as immediate danger from an avalanche, which place the rescuers or patient at risk. You must control or reduce these hazards before beginning patient care. Another example, but one that you can take care of during or after the ABCDs, is hypothermia. With the slow response times common to wilderness rescues, hypothermia due to conduction to the cold ground is a significant concern. Therefore, unlike on the street, you **should** generally move patients (via log roll, if needed) to place insulation under them. Thus, hypothermia, danger of rockfall, etc. are hazards for you to address before, during, or right after primary survey, depending on the level of danger.

3. One general approach to the primary survey is presented below. This is not the only correct approach. However, airway **always** comes before everything except for hazards.

   a. **Step Zero: Assess and Manage Hazards**. The first principle in management of the injured in the outdoors is to take care of **hazards**. Start emergency care only after you ensure safety (the patient's **and** yours) from hazards, such as falling, rockfall, severe cold exposure, or flooding.

   (1) When assessing hazards, remember your priorities. To be an asset and not a liability, you must stay uninjured yourself. You come first, your team members come second, and the patient is third. Search and rescue sayings to remember:

   (a) "A dead rescuer never did anyone any good."

   (b) "There is no one worth dying for out there."

   (c) The Coast Guard has a saying: "The rules say you have to go out. Nowhere in the rules is there anything about coming back."

   (2) **EXAMPLE:** A 25 year old white male hiker has fallen off of a ledge and landed in the branches of a tree. He is still 20 feet in the air and about 35 feet below the top of the cliff face. He is not speaking to people on the ground. When you access the patient, prior to checking the airway, you secure yourself and the patient, then begin to check the airway. REASON: If you do not secure yourself, you could easily fall out, and while 20 feet is not far to those of us used to working on 400 foot open faces, it is still far enough to break your neck! You must secure the patient, as you could dislodge him in the process of opening his airway.

   b. **Step 1: Primary Survey**. Do a **primary survey**, looking for life-threatening conditions; correct them as you find them. There are only a few absolute rules in first aid, but one of them is: always check Airway, Breathing, Circulation, and Disability, in that order. The primary survey may be as simple as asking the patient "Are you alright?" If you get a "No, dammit, I think I've broken my ankle" then you can assume that airway and breathing are OK.

   (1) **Step A: Airway.**

   (a) You should use the same airway care in the wilderness as elsewhere. In suspected trauma cases, don't open the airway opened using the head tilt. Use the chin lift or jaw thrust and **protect the cervical spine**.

(b) Care of the airway is important **after** the primary survey as well. In a comatose patient, the danger is more to the lungs, than to the airway. Aspiration of secretions or vomit may obstruct the airway, of course, but stomach acid or food in the lungs will lead, in short order, to pneumonia. If the patient is unconscious or semi-conscious, use the coma position (left lateral decubitus position) to protect the airway and lungs. Stabilize the neck (e.g., with a cervical collar and padding and duct tape) if you suspect cervical spine injury. You may use this modified coma position in a litter, with appropriate cervical spine stabilization if needed. If you have any doubts about the patient's ability to protect his or her airway, and a Wilderness EMT-P is present, intubate the trachea.*

(2) **Step B: Breathing**. Assess adequacy of respiration: **look, listen, and feel:** Is the respiratory effort adequate? If not, start treating it.

(a) **Step B-1: Artificial Respiration** Mouth-to-Mouth ventilation has significant dangers of communicable diseases. Bag-mask or mouth-to-mask ventilation is less risky. Effective bag-mask ventilation is very difficult; use mouth-to-mask if there is any problem using a bag-mask.

(b) **Step B-2: Plug Sucking Chest Wounds** at the end of exhalation. You should remember from your EMT training that, if a tension pneumothorax develops, you should unplug the hole for a minute, then plug it up again. You should tape the occlusive dressing on three sides, so that it will act as a flutter valve, allowing air to escape as pressure builds.

(c) **Step B-3: Splint Major Flail Chest.** A flail segment is part of the chest wall that has multiple fractures around it. The intercostal muscles cannot pull it up and out with the rest of the chest. The problem with a flail segment is that as it "flails" in and out opposite to the normal chest expansion (paradoxical movement), air just shunts back and forth between the two lungs. You should stabilize it with a cave pack, sweater, or other splint; this will allow the lung on the good side to work. If this is not enough to produce effective ventilation, start positive pressure ventilation (mouth-to-mouth or bag-mask). Positive pressure ventilation can be quite effective even with a large flail chest, provided there is no pneumothorax or hemothorax.

(d) **Step B-4: Check for and Reduce any Significant Pneumothorax.** On the street, an EMT-P only reduces a severe tension pneumothorax; but, in the wilderness, the WEMT-P may need to reduce a less-severe pneumothorax, or may need to place a chest tube to drain a hemothorax. Continued respiratory distress in the setting of a pneumothorax or hemothorax generally indicated the need for wilderness drainage. The extra work of breathing with a pneumothorax or hemothorax may, during a long evacuation, result in the patient tiring and developing respiratory failure. If needed, use an IV catheter to aspirate a pneumothorax; leave the catheter in place

* Schwartz's first law (Earl Schwartz, MD) says: If the patient lets you intubate, the patient obviously needs it!

for later use, plugging it with a small syringe.

(3) **Step C: Circulation**. Check the carotid pulse. (See the *Wilderness Medical Problems* section for more on checking the pulse in hypothermic patients.)

(a) **Step C-1: Cardiac Resuscitation**. Initiate BCLS and ACLS as appropriate (though they are rarely useful in the wilderness). (See the *Wilderness Medical Problems* section for more on CPR and ACLS in the wilderness.) Closed chest CPR in a multiple trauma patient is of questionable value, even on the street. Check for treatable causes of traumatic cardiac arrest:

i) airway obstruction,

ii) tension pneumothorax,

iii) hypovolemia, and

iv) pericardial tamponade.

(b) **Step C-2: Control Severe Bleeding**. (You will find more on wound management in the *Wilderness Surgical Problems* section.)

i) Check for severe bleeding: use direct pressure and elevation to stop it. Pressure points are rarely useful.

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

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

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

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

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

vii) Various materials can be placed into or onto wounds to help staunch bleeding. Thrombin powder works well. However, only one particular brand and type is stable for more than thirty days at room temperature.*[1] Other common materials include GelFoam™ and oxidized regenerated cellulose (Surgicel™), both of which are stable at room temperature.

(c) **Step C-3: Detect and Start Treating Severe Shock.** (More on shock may be found in the *Wilderness Trauma* section.)

i) Check the pulse to diagnose life-threatening shock: a weak, thready rapid pulse means a narrow pulse pressure; in an anxious, thirsty patient this indicates shock. Look for treatable sources.

ii) If a radial pulse present, the mean pressure is more than 90.

iii) If a femoral pulse present, the mean pressure is more than 60.

iv) If a carotid pulse present, the mean pressure is more than 50.

v) Treat: elevate legs, keep warm, reassure; MAST as temporizing measure; give IV fluids, O_2.

(4) **Step D: Disability/Disrobe.** Perform a brief neurological exam and undress the patient for a full exam. (More on neurological exams is presented later in this section).

(a) As part of the primary survey, you must make only a very quick assessment of Level Of Consciousness (LOC). Use the AVPU system: **A**lert, responds to **V**erbal, responds to **P**ain, or **U**nresponsive. Assessing this only takes a second or two.

(b) Remember that a decreasing level of consciousness may be a clue to closed head injury, airway problems, or developing shock.

(c) Cutting off the patient's clothing is a standard Emergency Department maneuver. In the wilderness, cutting off someone's clothes may make it hard for them to walk out later. You will need to exercise your judgment about what to cut, what to take off, and what to leave on. **In general, the less experience you have at physical exams, the more you should tend toward undressing a wilderness patient.** If you are sure you'll be evacuating the patient in a litter, cut the clothes up the front of the arms, legs, and up the

* Thrombin 5,000, 10,000, and 20,000 units (topical powder), Johnson & Johnson, is stable for three years at room temperature.

middle of the torso. If you need the patient's clothes for insulation, patch them together with a few pieces of duct tape.

(d) If you're absolutely sure the patient has no injury except an ankle fracture, you can get away with just undressing and examining the ankle. This has the advantage of keeping the patient warmer and not embarrassing you or the patient. But, it may make it hard to explain later the subcapsular hemorrhage of the spleen that you missed because you didn't examine the abdomen.

c. **Step 2: Manage**. If you are part of an organized Field Team, your FTL (Field Team Leader) can manage for you, allowing you to concentrate on taking care of the patient. If you don't have a FTL, then you must, for the patient's benefit, step back and manage. Stand back — Look — Think — MANAGE! Once the immediately life-threatening situations are under control, hold back and figure out what else needs to be done. If you get too deeply involved in first aid, you may lose track of other things that need to be done: (e.g., waiting 2 hours to send someone for help— it's happened!) Partition up the work to be done; find something for everyone to do. One of the hardest things to do is to delegate responsibility. (As one experienced rescue manager put it: "Don't just do something, **stand there!**") (Scene management is discussed further in the section on *Scene Management, Communications, Reporting, and Documentation*.)

d. **Step 3: Secondary Survey**. The secondary survey is a comprehensive head to toe survey looking for other injuries and constantly reassessing those areas covered under primary survey. When on the street or when transport will take the patient to the Emergency Department in just a few minutes, you do a secondary survey, just as taught in your EMT or Paramedic training. However, in the wilderness, you do a **directed history and physical** instead of a secondary survey. All wilderness EMT students, especially EMT-Basics, should review Chapter 2 (Human Systems and Patient Assessment) of Nancy Caroline's EMT-P text.[2] For more on histories and physical exams, read Barbara Bates' well-known book.[3]

4. To review:
   a. **Step Zero: Assess and Manage Hazards**
   b. **Step 1: Primary Survey**
   (1) **Step A: Airway**
   (2) **Step B: Breathing**
      (a) **Step B-1: Artificial Respiration**
      (b) **Step B-2: Plug Sucking Chest Wounds**
      (c) **Step B-3: Splint Major Flail Chest**
      (d) **Step B-4: Check for and Reduce any Significant Pneumothorax**
   (3) **Step C: Circulation**
      (a) **Step C-1: Cardiac Resuscitation**
      (b) **Step C-2: Control Severe Bleeding**
      (c) **Step C-3: Detect and Start Treating Severe Shock**
   (4) **Step D: Disability/Disrobe**
   c. **Step 2: Manage**
   d. **Step 3: Secondary Survey**

C. Introduction to the history and physical

1. Traditionally, we call what a doctor does a "history and physical" (history and physical exam), and we call what an EMT does a secondary survey. The principles are the same for both. However, in the wilderness, you must do a more in-depth evaluation than on the street. In the wilderness, your secon-

dary survey is extensive enough to be called a history and physical, and therefore that's what we're calling it.

2. Medical students are taught that eighty percent of the diagnosis is made by history. Physical exam and laboratory tests contribute only about 20%. This applies to wilderness patients, too.

3. **Types of history and physical:** A history and physical can take 5 minutes (a driver's license physical for a well person) or hours (someone with a complex history and complicated medical problems). It can be a "complete" exam, such as for prospective NASA astronauts (i.e., one that lasts several months), or a limited "directed" exam, as when someone comes into the Emergency Department complaining of a twisted ankle. A directed exam is what you will usually perform in the wilderness.

4. The "directed exam" is just that: the extent and details of your exam are directed by the patient's complaint. For example, if the problem is a splinter under the fingernail, you don't need to do a rectal exam. For a splinter, though, you must ask about medical problems that might decrease resistance to infection: Any history of diabetes? On any steroids, such as prednisone?, and the year of last tetanus shot (they're good for 5-10 years; see the section on *Principles of General Medicine* for more about tetanus immunization).

5. Which comes first: history or physical? Actually, most physicians mix the two together. A bit of questioning gives you an idea of the general problem, and you can start examining the patient while asking more questions. Use your time efficiently. Talk to your patient as you examine. You gain more information and it reassures the patient.

6. How do you decide what to ask, and what to examine? It depends on what the complaint leads you to suspect.
   a. If you suspect a pulmonary embolism is causing the patient's chest pain, you ask about shortness of breath, about risk factors for pulmonary embolism, and about swelling in the legs that might indicate a deep venous thrombosis, and listen to the lungs and feel for calf tenderness. If you suspect the chest pain is caused by pneumonia, you ask about shaking chills and the color of the patient's sputum, and you listen to the chest and percuss it very carefully. If you think the chest pain might be due to an ulcer, you check the abdomen for epigastric tenderness (just under the rib cage, in the center) and hyperactive bowel sounds, and do a rectal exam looking for melena (black, tarry stool).
   b. You'll probably have to go back and ask new questions and examine for new findings as new thoughts occur to you. That's normal. Your suspicions and your medical knowledge are your guides to the history and physical.

7. How do you start? Here are some good general rules.
   a. **Be confident,** or at least act it.
   b. Introduce yourself in a way that will induces confidence in your patient. You'll be together for a while, and you need to develop a good rapport. Let the patient know your level of training. ("Hi, I'm Joe Rockjock. I'm a Wilderness EMT-Paramedic with the Appalachian Search and Rescue Conference.")
   c. If you need to examine something, **examine it**. Your choice of examination is based on your suspicions and the history; don't be put off by having to ask the team leader for a few more minutes to expose a body part in order to examine it.

d. **Avoid surprises.** People who are hurt don't like surprises. Let the patient know what you're doing.

e. On the other hand, don't spend a lot of time talking about what you're going to examine, and don't act as though you're waiting for the patient's approval...it makes you look unsure of yourself. (An example of good technique: the patient just spent 30 seconds explaining what happened when he fell and where he hurts, while you're getting your medical bag out of your pack. You say, as you're starting to examine him from the head down: "I'm going to check you over from head to toe. I know that only your ankle hurts, but I'm going to check everything from head to toe anyway.")

f. Don't say "everything will be all right"; after all, it obviously **isn't** all right. If it was, you wouldn't be there, would you? And, since you're lying about "everything being OK," why should the patient trust anything else you say?

g. Don't "lead the witness." Ask patient "what's the matter?" or something similar and let the patient tell you. This can become time consuming, but usually provides much more information than if you try to wring the story out of the patient. If, instead of a succinct story, you start getting a wandering hour-long discourse, then you can start being more directive. If the patient seems confused, or the story makes no sense at all, and only as a last resort, start asking yes or no questions. ("Does your chest hurt now? Did it hurt before you fell? Did it hurt yesterday?")

h. Once the story starts to make sense in terms of your medical knowledge, then flesh out your History of the Present Illness (HPI) by asking specific pertinent questions. ("OK, you threw up some blood...How much? How many times? Have you had any diarrhea? How do you feel when you stand up?")

i. Use all sources of information: the patient, other witnesses, friends and family, or other search and rescue or medical personnel who may have gotten there first.

j. **Document your findings.** You will not remember all the details 4 hours later, let alone 2 days later. You will have to pass along the pertinent information to your relief. You should record what treatments you have given, and what effect they have had. Lastly, and its sad to say we have to worry about this, a complete and accurate medical record is your best defense if the patient decides to bring a suit against you. If you didn't document how you found him and what you did, even though he was intoxicated and climbing a 200 foot cliff without any protection when he fell 75 feet and had no palpable blood pressure when you got to him, it's still your fault that he can no longer play the violin.

D. The History

1. The history is usually divided up in a standard way. The components are the **Chief Complaint** (CC), the **History of Present Illness** (HPI), the **Past Medical History**, (PMH), and the **Review of Systems** (ROS). In wilderness rescue, don't worry too much about whether information is part of the chief complaint, history of present illness, or past medical history, as long as you've got all the proper information together. However, to help you understand the standard "official" format for a history and physical exam, we'll now discuss each part, in turn.

2. The **Chief Complaint** is why you're taking care of the patient. E.g., "Patient fell off a cliff." "A rock fell on her, and her

arm is broken." It's considered good form (but not required) that you use the patient's own words: "I've been lost for 5 days and feel lousy all over." "My plane crashed and my neck and head hurt." "I've had chest pain all day and now can't breathe right." Key questions to ask for pain or discomfort include:

a. **Where** does it hurt? "My arm hurts." "I hurt my back."

b. Does the pain radiate or move? Examples: Chest pain radiating to the left arm and neck suggests a cardiac cause. Chest pain radiating to below the right scapula suggests a gall bladder problem.

c. Describe it: **how** does it hurt?. Sharp? "Like a knife stabbing me." Dull? "Like someone standing on my chest." Heavy? Constant? Coming and going in waves?

d. **How much** pain; how bad is it? For chest or other pain, it's traditional to rate it on a 1-to-10 scale. "Say that a 1 is pain you can just barely feel, and a 10 is the worst pain you can imagine. How bad is this chest pain?" Sometimes, the severity of the pain may make you think of certain diseases. "This is the worst headache of my life." When the patient gives you this statement, you must think of a subarachnoid hemorrhage. This is discussed further in the *Wilderness Medical Problems* section.

e. **When** did it start? How long has it been there? One hour, one day, a week, three years? It is amazing how often people come to the hospital at 0300 hours with a pain that they have had for years. Though this is less likely in the wilderness, you must be prepared to deal with such complaints at base. It is important to at least find out **why** they came to you tonight. What changed?

f. How did it start? Suddenly or slowly? Often pain which begins suddenly and remains severe suggests a more severe problem than one that begins gradually. E.g., sudden onset of severe mid-epigastric pain that doubles the patient over is suggestive of a perforated duodenal ulcer.

g. Has this ever happened before? "I've had this same pain and vomiting 15 times before, and it's always been small bowel obstruction from adhesions; you know, scars in my abdomen from all those operations I've had."

h. **What** makes it better? Worse? Changing position? Taking a deep breath? Laughing?

i. Did anything else happen at the same time? (**Associated symptoms**.) You should ask about specific symptoms that you expect, depending on the complaint and what your history and physical has revealed thus far. Examples: a patient with epigastric abdominal pain might have melanotic diarrhea (black tarry stools) and orthostatic symptoms suggesting a GI bleed. Nausea, vomiting, and diaphoresis (profuse sweating) in a patient with chest pain suggests an MI. Recurrent projectile vomiting, in a patient hit in the head, should increase your suspicion of a closed head injury or intracerebral bleed.

j. You may use the **PQRST** mnemonic: what **P**rovokes (and what Palliates, and about Past episodes of) the problem, the **Q**uality of symptoms, the **R**adiation of pain, the **S**everity (i.e., on a 1-to-10 scale), and the **T**ime course of symptoms.

3. The **History of Present Illness** includes history pertinent to the chief complaint only. Examples: (for a otherwise healthy lost person): "The patient has had nothing to eat for 5 days and no water for 2 days," or: "The patient has mild diabetes, lost her pills, and has been without them for 4 days." For a fall: "The patient complains of pain in the neck and head,

but denies neurological or visual symptoms, and has been walking through the woods all day." For a patient found with shortness of breath at a hunters' camp: "The patient has had his anginal chest pain more often than usual the past few days, and complains of three days of increasing pedal edema."

4. The **Past Medical History (PMH)**, in a hospital history and physical, is very complete. For a wilderness history and physical, you don't need to ask about details of all past illnesses and surgeries. You do want to ask about continuing medical problems such as diabetes, heart disease, and hypertension, and about any recent surgery. Allergies and medications are always relevant. Here are some examples of relevant past medical history for a wilderness patient. "The patient is now on just diet and diabetes pills, but was on insulin for a few months last year. The patient says that he was very sick, and then in the hospital for two weeks, when he went off his diet three years ago." "The patient had a heart attack two years ago, and is currently on digoxin and diltiazem for irregular heart beats and chest pains."

a. A formal past medical history is usually divided up as follows:

(1) **medical history**;

(2) **surgical history**;

(3) **family history**;

(4) **social history**;

(5) **medications**; and

(6) **allergies.**

b. The **medical history** in a formal history and physical exam will include details of all major past illnesses and hospitalizations, and any ongoing medical problems.

c. The **surgical history** includes any major operations. For example, knowing that the patient has had his appendix removed eliminates appendicitis from the possible causes of his abdominal pain.

d. The **family history** asks about family members (blood relatives) that have diseases that tend to run in families. For example, for a patient with chest pain, you ask about blood relatives having heart attacks at an early age, which is a risk factor for coronary artery disease.

e. The **social history** asks about elements of the patient's social situation that might have effects. Examples include type of work (e.g., a coal miner who might have "black lung"), the home situation (e.g., exposure to others with gastroenteritis), and use of recreational drugs, including tobacco smoking, alcohol, or other drugs. For wilderness patients, the "home" situation is the wilderness environment. Relevant factors include the weather and terrain, and possible exposure to other members of a wilderness group who have infectious diseases.

f. **Medications** are a vitally important part of the past medical history. Medications are often a good clue to the patient's medical history. Remember, patients often do not think of over-the-counter medications as medicine. Ask specifically if they are taking aspirin (which can interfere with blood clotting), acetaminophen, cold preparations, or other over-the-counter medications. ("Well, I'm not on any medicine, but I have been taking about 30 aspirins a day for a bruised ankle. Do you think that has anything to do with my throwing up blood?") If relevant, include tobacco, alcohol, and recreational drugs. ("Yeah, well, we did a little coke before we went hiking. Do you think that's why John is having this chest pain?")

g. Finding out about **allergies** is of vital importance (especially if the patient becomes unconscious later).

h. There are two other items of past medical history that are appropriate to ask about for any wilderness patient:

(1) For wounds, you will want to ask whether the patient has had a **tetanus shot** within the past 5 or 10 years. (Tetanus immunization is discussed further in the section on *Principles of General Medicine*.)

(2) **Ask about the time of the patient's last meal.** If the patient may need surgery, this is important information for the anesthesiologist. This is less-important when the patient is many hours away from the operating room, but still worth asking about. (See the section on *Principles of General Medicine* for a discussion about wilderness patients and oral fluids or food.)

i. You may want to use the common mnemonic **AMPLE History:** **A**llergies, **M**edications, **P**ast history, **L**ast meal, and **E**vents leading up to illness or injury.

5. The **Review of Systems** is fishing for information, asking specifically for problems with each of the major organ systems. For most directed exams, you don't need to do a review of systems. But, if you're totally baffled about what's going on, you may want to start a review of systems. Go from head to toe. Ask in terms the patient can understand. Assume the patient, for whatever reason, may not volunteer information. For a review of systems, ask about problems with:

a. eyes, ears, nose, throat?

b. neurological or psychiatric problems?

c. lung or heart problems?

d. stomach or belly problems?

e. kidney problems?

f. female problems? last menstrual period? (for women)

g. bone or joint or muscle problems?

h. blood or bleeding problems?

i. diabetes, thyroid, or other endocrine problems?

6. **Directed Questioning Based on Medical Knowledge:** The history is guided by what the patient tells you, but also by what you think is going on. If the patient tells you that she has back pain, you may ask about urinary frequency, urinary urgency, and dysuria. Why? Because you know that urinary tract infections are common in women, and kidney infection can cause back pain, even without fever. During your physical exam, you check for costovertebral angle tenderness (CVA tenderness, also abbreviated as CVAT) as a possible clue to a kidney infection (pyelonephritis; discussed in the section on *Wilderness Medical Problems*). On the other hand, assume the pain began after lifting a heavy box and radiates down her right leg. You would check for tenderness over the lumbar spine, for weakness in that leg, and for decreased reflexes, weakness, or numbness in the legs, because you are suspecting a possible herniated disc (discussed in the section on *Wilderness Surgical Problems*). The point is that your history and physical is guided by your medical knowledge: the more you know, the more you can make your exam shorter, more directed, and better. There is no single checklist for a good history and physical.

E. Physical Examination: General

1. You examine each area of the body by using the same four basic principles: **inspection, palpation, percussion,** and **auscultation.**

a. **Inspection:** Look at the area. Is there swelling? deformity? bruising? Most people are bilaterally symmetric. You can always compare one side with the other.

b. **Palpation:** Feel the area. Is there crepitus? (crunching or grating, caused by broken bone ends, irritated tendons, or air under the skin). Is it tender when you touch? Do you feel a mass?

c. **Percussion:** Tap on the body part and listen for the echo. Specifically, press the fingers of one hand firmly against the body, and use the tip of a finger of the other hand to tap firmly on one of your knuckles. Dullness suggests fluid below, while sounds like a tin drum suggest air under pressure. The technique is most useful when examining the chest and abdomen.

d. **Auscultation:** Listen with your stethoscope. Practice on yourself to learn what "normal" breath sounds are like. Do you hear crackles, like when you roll up cellophane? (Râles, heard with fluid in the lung.) Are breath sounds absent on one side? (Probably a pneumothorax or hemothorax!)

2. **Vital Signs:**

a. Vital Signs are the same in wilderness as elsewhere, except that temperature is so very important.

b. You may want to include orthostatic BP and pulse when appropriate: check pulse and blood pressure when lying and then after a minute of sitting, and then after a minute of standing. (Don't let the patient lose consciousness and fall.) If on standing, the patient complains of getting dizzy or lightheaded, you have a pretty good idea that the patient "tilts" and is low on volume. The official minimums for orthostasis are a drop of 10 in systolic BP or an increase of 20 in pulse.

c. When checking vital signs on a regular basis, you may want to add a repeat abdominal exam, repeat neurological exam, or other checks, based on patient's problem. Remember: patient care is a dynamic process. Reassessment of the patient is important to detect deterioration of the patient's status, and to assess the effectiveness of the interventions that you have made.

d. Details of temperature measurement, an important wilderness vital sign, are provided under *Monitoring*, below.

3. **The Directed Physical Exam vs. the Screening Exam:** Now that we've spent a lot of time saying that there is no checklist for a history and physical, we'll give you such a checklist. This particular list is of items you should check when doing a physical exam after minor trauma. (E.g., someone who just took a minor fall, and feels fine, but "wants to be checked.")

a. Feel the head and face, check the pupils and extraocular motions, and look in the ears, nose, and throat;

b. feel the neck for tenderness or spasm, and ask patient to perform a full range of neck motion (see the section on *Wilderness Surgical Problems* for guidelines for clearing the cervical spine in the wilderness);

c. palpate the shoulders and upper extremities, and ask patient to show full range of motion of all joints;

d. listen to the lungs and palpate the chest;

e. palpate the back;

f. listen to the heart;

g. palpate the abdomen;

h. check for pelvis stability; and,

i. palpate the lower extremities and ask patient to show full range of motion there.

F. Detailed Exams

1. The following material outlines a relatively complete physical exam for each area of the body.
2. During a directed exam, you will only examine the relevant areas. However, you can never go wrong doing a quick general screening exam, as described above, on every patient.
3. The musculoskeletal exam is found in the section on *Wilderness Surgical Problems*, and the eye exam, in the section on *Wilderness Medical Problems*, rather than here.

G. General Assessment and Skin

1. **General appearance:** OK? Sick? Unkempt? Is patient in distress? Resting comfortably?
2. **General state of consciousness:** reassess **AVPU** (Alert/not alert but responsive to **V**erbal stimuli/responsive only to **P**ain/**U**nresponsive). You will want to specify further: Hyperactive? Violently agitated? Confused? Lethargic?
3. **Skin:** Moist? Dry? Cold? Hot? Pale? Cyanotic? Rashes?
4. **Rashes:** define in standard dermatologic terms
   a. **papule:** a small bump (a few millimeters)
   b. **macule:** a small discolored patch that is not palpable.
   c. **nodule:** a large bump (more than a centimeter)
   d. **patch:** a large macule
   e. **vesicle:** a tiny blister
   f. **bulla:** a large blister

H. Head, Ears, Eyes, Nose, Throat

1. **Head:**
   a. Palpate for bony tenderness or deformity of skull or face bones. Don't jump to conclusions: sometimes scalp hematomas feel like fractures. Palpate firmly, but don't press bone fragments into the fracture.
   b. Look for periorbital ecchymosis (Raccoon eyes) that suggest a face fracture, or retroauricular ecchymosis (Battle's sign) suggesting a basilar (base of the skull) skull fracture.
   c. Check for normal movement of the jaw; ask about normal dental occlusion ("do your teeth fit together right?").
   d. Grasp the upper jaw teeth and wiggle to see if the face bones are stable (checking for loose "LeFort" facial fractures).
   e. Facial fractures may put the airway at risk, from bleeding and because they may make intubation difficult.
2. **Ears:** look for blood in the canal; if an otoscope is available, look behind the tympanic membrane (a dull blue color is characteristic of hemotympanum) or for lacerations of external canal, all suggesting skull fracture.
3. **Eyes:**
   a. Ask about the patient's vision; check the ability to read a handy label with each eye if indicated.
   b. Check the pupils for equality and reaction to light (if normal, then Pupils Equal and Reactive to Light, abbreviated as "PERL") and for extraocular motions ("EOMI" means ExtraOcular Motions Intact). Check extraocular movements to look for trapping of lower rectus muscle from a blowout fracture of the orbit, and as part of your neurological exam.

c. Inspect for evidence of trauma if the patient reports a foreign body sensation or is unconscious (discussed in the *Wilderness Medical Problems* section).

4. **Nose:** Palpate for deformity or point tenderness over nasal spine indicating a fracture; inspect for bleeding or a septal hematoma (a blood clot under the mucous membrane of the septum in the middle of the nose (discussed further in the section on *Wilderness Surgical Problems*).

5. **Mouth:** Examine for lacerations, check that the patient can protrude the tongue in the midline (deviation to one side suggests a neurological problem); if the tonsils are swollen or the throat is red, it suggests infection.

I. Neck

1. If you suspect meningitis, check for suppleness: the ability to move the neck in all directions without pain.

2. Palpate for deformity or tenderness (raises suspicion of neck fracture, with the history of a fall or trauma) and fir muscle spasm and tenderness (seen with strains or fractures), for SQ air, and for lymph nodes (swollen glands).

3. Palpate the larynx for pain or deformity, suggesting a fracture. This is a high risk injury for airway compromise; endotracheal intubation may be difficult with such a fracture.

4. If you suspect fluid overload or CHF, examine for jugular venous distension at 30°-45° elevation of the upper body. Look for external jugular distension, and for the internal jugular pulse, using oblique light from a penlight. (This is discussed in more detail in the *Wilderness Trauma* section under fluid overload.)

5. If you suspect a tension pneumothorax, palpate in the sternal notch for tracheal position.

J. Chest

1. **Lungs:**

a. Inspect for retraction, asymmetric movements, accessory muscle use, and deformity or bruising (bruising over the anterior chest raises the possibility of myocardial or pulmonary contusions).

b. Palpate for unstable sections, for point tenderness indicating a rib fracture, and check the stability of the whole chest by pressing anterior-posterior and side-side. (Tenderness over the left lower anterior ribs indicating rib fractures there makes one worry about damage to the underlying spleen; such a patient needs close monitoring for developing shock.) If you suspect pneumonia, you may palpate for vocal fremitus (have the patient say "ninety-nine" while your hands are on the chest.) An increase in a single area may suggest a pneumonia in that area.

c. Percuss for equality of lungs, and for local dullness indicating hemothorax or pneumonia.

d. Auscultate for râles, rhonchi, wheezes, and quality of breath sounds.

2. **Heart:** listen for the rhythm and rate, and for any murmurs. An S_3 gallop is a clue to fluid overload or to congestive heart failure. Normal heart sounds have a "lub-dub" rhythm, whereas with an S_3 gallop, it's a "lub-dup-it" rhythm, better associated with the rhythm of the word "Ken-tuck-y." The S_3 gallop is heard best with the bell of the stethoscope held lightly over the skin of the apex of the heart, under the nipple. It is also heard best with the patient leaning over slightly to the left. It takes plenty of

practice to learn to appreciate a third heart sound. For more on examination of the heart, read Bates.[3]

3. If you suspect meningitis, check for suppleness: the ability to move the neck in all directions without pain

K. Back

1. Inspect for signs of trauma, palpate for tenderness, check for costovertebral angle tenderness (CVA tenderness, abbreviated as CVAT) suggesting kidney infection or damage, or an impacted kidney stone. Palpate along the spinous processes; point tenderness suggests bony injury or a herniated disc.
2. Check for straight leg raising (you raise the supine patient's thigh while keeping the knee flexed; when you straighten the knee, pain radiating down leg suggests a pinched nerve from a herniated disk.

L. Abdomen

1. **Inspect:** for bruising along the flanks suggesting internal bleeding), and for distension.
2. **Auscultate:** for bowel sounds (listen 2-3 minutes before deciding no bowel sounds). Are the sounds normal? Or are they hyperactive? (As with gastroenteritis, or GI bleeding, or right after a meal.) Are they high-pitched and tinkling? (Suggesting bowel obstruction.) Or, are they absent (this is an **ileus**, which may come from trauma, gastroenteritis, severe illness, or shock; see the section on *Burns and Lightning* for more on ileus.)
3. **Palpate:**
   a. for voluntary or involuntary guarding;
   b. for rebound tenderness (tenderness that is worse when you release pressure than when you're pressing);
   c. for referred tenderness (tenderness in an area other than where you're pressing; for instance, if you press in the right upper quadrant, and the patient says that you're making it hurt in the right lower quadrant); and
   d. for deep tenderness or masses.

M. Genital/Rectal

1. Inspect for perineal ecchymosis (which suggests retroperitoneal bleeding), for blood from urethra, and for lacerations.
2. Perform a rectal examination with a gloved finger; note the tone (normal? flaccid?), palpate men's prostate gland for normal position (we generally don't put in Foley catheter if the prostate seems higher than normal, suggesting urethral rupture), and look for blood on your finger.
3. If the patient has abdominal pain, vomiting, or groin pain, check for a mass above the testicle or swelling in groin. This may be due to a hernia (an outpouching under the skin of abdominal contents, coming through a weak place in the abdominal wall) If it incarcerates (gets trapped) the patient may develop bowel obstruction and severe abdominal pain with vomiting.

N. Neurological exam

1. For most urban patients, your neurological exam is limited to a quick assessment of level of consciousness, using the AVPU system or the Glasgow Coma Scale. The AVPU system described above is ideal for a primary assessment, or for a "scoop and run"operation with an urban trauma patient, and the GCS is an ideal exam for routine street EMT use, but a more detailed exam is appropriate for wilderness patients.

2. **The Glasgow Coma Scale** *(GCS) is a 3 to 15 scale (a corpse, or for that matter a rock, gets 3; 15 is normal). The GCS measures three items: first, how much effort it takes to get the patient to open his or her eyes; second, the best verbal response the patient makes; and third, the best motor response the patient makes.*
   a. *Eye Opening*
   (1) *Spontaneous: 4*
   (2) *To Verbal stimulation: 3*
   (3) *To Pain: 2*
   (4) *No Response: 1*
   b. *Verbal Response*
   (1) *Oriented: 5*
   (2) *Disoriented: 4*
   (3) *Inappropriate: 3*
   (4) *Gibberish: 2*
   (5) *No Response: 1*
   c. *Motor Response*
   (1) *Obeys Commands: 6*
   (2) *Localizes Pain (e.g., reaches out and pushes your hand away): 5*
   (3) *Withdraws from pain: 4*
   (4) *Decerebrate posturing: 3*
   (5) *Decorticate posturing: 2*
   (6) *No Response: 1*
   d. *Total 3 - 15*
3. For the wilderness, you will often need to perform a more detailed neurological exam. A formal neurological exam is usually divided up into **six parts**, each one of which checks a specific part of the nervous system. (If you would like a mnemonic for this, you can use **Mental Cases Sometimes Make Deepdish Casserole: MCSMDC***.)
   a. **Mental Status (MS)**
   b. **Cranial Nerves (CN)**
   c. **Sensory (S)**
   d. **Motor (M)**
   e. **Deep Tendon Reflexes (DTRs) and Babinski response in toes**
   f. **Cerebellar (C) (and possibly Gait)**
4. Here is a detailed review of each of the six parts of the formal neurological exam.
   a. **Mental Status**
   (1) **Alertness:** Is the person alert? Lethargic? Sleepy but easily arousable? Stuporous?
   (2) **Orientation:** Is the person oriented to time, person, and place?
   (3) **Cognition and Memory:** Can the person remember 3 words at five minutes (e.g., house, car, Baltimore). Can the person identify simple objects at hand (e.g., pencil, whistle, notebook). Does the person knows who is president or the state capital? Can the person add 2 + 2, or 33 + 212? (You don't need to do any of these specific tests, but during your history, you should get some general impression of cognition and memory.)
   (4) **Affect (mood):** Sad, as in depression? Flat, as with some people treated with antipsychotic drugs like Haldol®? Inappropriate, with laughing when saying sad things, as in psychosis or schizophrenia?
   b. **Cranial Nerves**
   (1) *There are 12 cranial nerves. You don't need to know the names or functions of all the cranial nerves. But, the you should be able to do a simple, standard, neurological exam of the cranial nerves. First, for your background information, we'll give you a complete list of the 12 nerves:*
   (a) **CN I:** *olfactory nerve. Not tested.*

* Those with better mnemonics should contact the Task Group Leader immediately.

(b) **CN II:** *optic nerve. Check the visual acuity, and the pupil's response to light.*

(c) **CN III, IV, and VI:** *Move the eyes around. These were already checked when checked extraocular motions*

(d) **CN V:** *face sensation. Test by touching face in several areas.*

(e) **CN VII:** *face movement. Have patient smile and raise eyebrows.*

(f) **CN VIII:** *hearing. Test by rubbing fingers next to each ear.*

(g) **CN IX and X:** *control throat muscles. Not checked.*

(h) **CN XI:** *elevates shoulders, turns head to side. Check by having patient hold up shoulders and press down on both shoulders, checking for strength; or, have patient try to twist head against resistance.*

(i) **CN XII:** *protrudes tongue. Already checked when you checked the throat and asked the patient to stick out the tongue.*

(2) Here is a good, standard WEMT screening exam for the cranial nerves:

(a) Check vision in both eyes (counting fingers or reading a handy label);

(b) Check the eyes to assure that PERL and EOMI;

(c) Check for hearing in both ears (rub fingers next to first one ear and then the other);

(d) Have the patient stick out the tongue in the midline; and

(e) Have the patient hold both shoulders up while you push down.*

c. **Sensory:** check for light touch (and possibly pinprick) on both sides of the face (top, middle, and bottom: six places on the face) and in all four extremities.

d. **Motor:** check strength of facial movement on both sides and for good strength in all uninjured extremities.

e. **Deep Tendon Reflexes and Babinski Responses:**

(1) Deep tendon reflexes (DTRs) help keep the tension in an active muscle constant and its action smooth. By tapping firmly on the tendon attached to a muscle, we can "fool" this reflex into making the muscle tighten for a second. Tap on tendons and look for a reflex twitch of the attached muscle. People vary widely in the strength of their DTRs; what counts is the symmetry of the reflexes on opposite sides. Damage to the brain usually causes increased reflexes; injury to the spinal cord usually causes decreased reflexes at the beginning, but increased reflexes later. Reflexes are graded from 1 to 4. Undetectable reflexes are 0 (or this may indicate you just need more practice); normal is a 2. When reflexes are 3+, the reflex twitches back and forth a few times before stopping. With 4+ reflexes, the twitching back and forth may continue for a long time. People vary a lot in the activity of their reflexes. And, we don't expect WEMTs to be as good as a neurologist at finding reflexes. However, we expect a WEMT to be able to tell when reflexes are clearly hyperactive, or when there is a major difference between one side and the other.

(2) **upper extremity:** check brachioradialis (forearm), biceps (elbow), and triceps (upper arm) reflexes. If the patient is immobilized, you may not be able to check the triceps reflexes.

* The sensory and motor exam of the face is, strictly speaking, part of the cranial nerve exam. However, we have found it easier for EMT's to learn how to do facial motor and sensory exams as part of the general sensory and motor exam.

(3) **lower extremity:** check knee and ankle jerk reflexes.

(4) **Babinski test:** stroke the bottom of the foot firmly toward the big toe with a key or similar fairly sharp object. An involuntary reflex response makes the big toes go down in normal adults (or, sometimes, if the patient is ticklish enough, the whole foot retracts). (An exception: under one year of age, the toes normally go up.) With spinal or head injury, or with some severe metabolic problems, an adults' toes will go up. Don't worry about whether this is a positive, negative, normal, or abnormal test. Just say, for instance: "the DTRs are symmetric, and the toes go down on both sides."

f. **Cerebellar:** The cerebellum controls fine motions. Check the finger-to-nose test (have the patient touch his own nose, then reach out and touch your extended finger held at about arm's reach) or the heel-to-shin test (have the patient use his or her heel to trace a straight line from the opposite knee to the opposite foot). If one of these seems poor, you may confirm by rapid alternating movements (have the patient tap thumb and forefinger together as rapidly as possible).

5. **Gait:** Gait (walking) is a complex function that uses the motor, sensory, and cerebellar systems. It is not part of the standard neurological exam, but you may find it a useful test. Having someone walk a straight line, heel-to-toe, is a good test of overall neurological function. It is a particularly good test for someone who may have High Altitude Cerebral Edema (HACE).

6. **Making sense out of the neurological exam:** the following cases will be discussed in the practical station.

a. **Example:** A patient who had head trauma several days ago is now only slightly confused, but has decreased sensation and motor strength in his left hand and in his left leg. You find increased DTRs on left side, and the big toe on the left foot goes up with Babinski test. **Comments:** The nerve fibers carrying motor control from the brain, and sensations to the brain, cross from one side to the other. Thus, the left side of the brain controls the right side of the body, and vice versa. This crossing occurs in the lower parts of the brain. In this case, the patient has a subdural hematoma pressing on the right parietal lobe of the brain. This causes the numbness and weakness on the left side. The lack of brain control allows the spinal deep tendon reflexes to become more evident on the left side, and the Babinski test to be abnormal. Note that hyperreflexia may take several days to develop, especially after spinal damage, or may occur immediately.

b. **Example:** A team member is unconscious for a few minutes after slipping and hitting her head, and then wakes up and seems normal but a bit confused (the "lucid interval"). The neurological exam is normal, but she has a bruise over the left temple, and you see a hemotympanum on the left. Gradually, over several hours, she becomes confused, loses movement and sensation and DTRs on the right, then blows her pupils (both become dilated and fixed to light), first on the right and then on the left. She then seizes and then goes into respiratory and then cardiac arrest. **Comments:** In this case, the bruise over the temple suggests an epidural hematoma, a rapidly-building hematoma that presses on the left side of the brain, and, since it is caused by a rupture of an artery rather than the venous bleeding that caused the subdural hematoma discussed above, the neurological deterioration is faster. And, the higher pressure of the bleeding produces enough pressure to damage the brain severely.

c. **Example:** A team member slips and has a whiplash injury to the neck, but no head trauma. He is alert and oriented, but complains of having tingling in both index fingers; on exam, he has decreased sensation there, and decreased biceps reflexes on both sides, as well as some biceps weakness bilaterally. The neurological exam is otherwise normal. The neck exam shows some spasm and tenderness in the middle of the neck. **Comments:** This man has a cervical fracture until proven otherwise. He must be immobilized and transported, but there is no urgency about it. In this particular example, there is a stable fracture in the C5 area. After being seen by a neurosurgeon in the Emergency Department, was admitted for a CT scan and MRI scan of the neck. The fracture, although it caused no damage to the spinal cord itself, pressed on the spinal nerves traveling from the spinal cord out to the fingers.

d. **Example:** A team member is lifting the litter and has a sudden pain in low back radiating down the back of her left leg. The pain in the leg is worse with the straight-leg-raising test. She has localized weakness: she cannot stand on the toes of left foot, and they seem weaker than the other side when you have her press down with both feet. **Comments:** She has a classic "slipped disk." One of the intervertebral disks has "squeezed out" from between the vertebral bodies and is pressing on a nerve root. This patient will need to be carried out, on a well-padded backboard.

e. **Example:** A Field Team member, a 54 year old volunteer from local community, who you later find out has a history of hypertension but has stopped taking his medication, suddenly complains of a severe headache. He is alert and oriented, but has a slightly staggering gait. His BP is 180/130. His neurological exam is normal except for an extremely poor finger-to-nose test on the right. **Comments:** The exam clearly shows there is damage to the cerebellum on one side. For most strokes, there is really little that can be done, even in the hospital, except to protect the airway, control the BP, deal with complications, and await healing. Given the history of hypertension and his elevated pressure, a bleed into the cerebellum seems likely. Since there is not much room in the skull in the area of the cerebellum, and it is near the center that controls breathing, unlike most stroke patients, this patient might go into respiratory arrest at any second. This patient should be evacuated ASAP.

O. Temperature, Thermometers, and Temperature Monitors

1. EMT and paramedic training emphasize the importance of taking and monitoring vital signs. However, one vital sign that is especially vital in the wilderness is temperature. Temperature is seldom taken by urban EMTs, but is vital for any wilderness patients. As a wilderness EMT, you have two main requirements for measuring temperature.

a. First, you will want a single accurate measurement of core temperature when you first see a patient. A glass-mercury thermometer, if unbroken and still functioning, is adequate for this.

b. Second, you want to know, during the evacuation, whether the patient's temperature is going up or down. For this, an accurate reading is not as important as knowing whether the temperature is going up or down. For evacuation, inexpensive ($15) improvised continuous rectal temperature monitors may be valuable. Even if the temperature that they register is a bit off, they generally will accurately measure **changes** in temperature.*

2. There are several places where you can measure a patient's temperature: the skin, the mouth, the rectum, the axilla (armpit), the tympanic membrane (eardrum), or the esophagus.

   a. In a normothermic person, there is a fairly reliable relationship between oral and rectal temperatures: oral temperatures are about 0.7°F less than rectal. However, neither is a perfectly accurate reflection of the "core" temperature. The "core" temperature is hard to define. Different parts of the body have different temperatures, and the temperature varies with different amounts of heat stress. This applies to the "core," as well. For example, the brain has a high metabolic rate, and the brain temperature may well be higher than the heart temperature. In some studies, surprisingly, the rectal temperature was found to be **higher** than the temperature of blood coming directly out of the heart (the pulmonary artery).[4]

      (1) In a **hypothermic** patient, however, oral, rectal, and axillary temperatures (and even tympanic temperature as measured with some thermometers) may be colder than the true "core" temperature, especially during rewarming.[5,6,7] And, in a patient with heatstroke from running or hiking, heat generated by the legs may make the rectal temperature much higher than the true core temperature.[8] In general, rectal temperature changes more slowly than "core" temperature during rapid temperature changes, possibly because it is well-insulated from the rest of the core.[9,10]

      (2) If you measure a rectal temperature with the probe in the middle of a lump of stool, you merely find the temperature of a lump of stool; if you do a poor job of holding a thermometer in the mouth or axilla, the temperature you register will be lower than the actual temperature there.

   b. **Skin:** Feeling the forehead with the back of your hand provides useful information, though it is seldom a good measure of core temperature. It gives a rough indication of how much heat the patient's body is trying to lose. For instance, when a fever "breaks" (starts coming down), the forehead will be very hot and then sweaty as the body tries to lose heat to come down to a lower core temperature. A very cold forehead suggests the person is trying to retain heat; for instance, if hypothermic, or if suffering a shaking chill just at the onset of a fever. (See also the comments on disposable skin thermometers, below.)

   c. **Oral Temperature:** The most routine place to measure temperature is in the mouth. It is convenient, because it doesn't require the patient to undress. It is rarely objectionable to adult patients. Oral temperature is affected by smoking and drinking cold or hot drinks, and is decreased by mouth breathing, and by increased respira-

* Dr. Conover performed some highly informal experiments at a Radio Shack™ store on nine similar indoor-outdoor thermometers, model 63-842, which showed a range of slightly less than 1°C in their temperature accuracy. However, all seemed to accurately indicate **changes** in temperature to within 0.1°C, over a 40°C range. The methodology was simply to put all nine external temperature probes together and to expose the cluster to varying hot and cold temperatures.

tory rates.[11,] (A study found that respiratory rates over 20 caused the oral temperature to drop by about half a degree C.[12]) However, effects of drinking and smoking disappear in 15 minutes.[13] Oral temperature is also increased by about half a degree by exposure to a warm environment (95°F=35°C)[14], and decreases by about 2°C just from sitting in a cool (12°C=59°F) room for 2 hours.[15]

d. **Axillary Temperature**

(1) As discussed in the section on *Thermal Regulation*, major blood vessels are close to the skin in the axilla (armpit). This allows a high rate of heat exchange with the core, and keeps the axilla closer to the core temperature than other parts of the skin. Having a patient hold a thermometer under the arm can provide a rough estimate of core temperature; axillary temperatures are accurate in hospitalized patients.[16]

(2) Axillary temperature can be a poor reflection of core temperature in deep hypothermia, because there is very little blood flow to the arms. It also may be hard, especially with an uncooperative patient, to get enough contact between the axilla and the thermometer to get an accurate reading. Several doctors recommend that you not use axillary temperatures to try to detect fevers, because they miss so many fevers in children.[17,18] However, in the wilderness, you could reasonably use a normal axillary temperature to rule out significant hypothermia.

e. **Rectal Temperature**

(1) Taking a rectal temperature is distasteful to many "street" EMTs. However, it is the accepted standard for wilderness first aid and wilderness rescue. Tympanic temperatures are superior, particularly in cases of exertional heatstroke, where the rectal temperature might be elevated above brain temperature by heat from the legs.[19] In other situations, rectal temperatures should be a fairly reliable estimate of core temperature.

(2) There are a few reports of rectal perforation in newborns when a rectal temperature was taken, but with reasonable gentleness, there should be no such danger in adults or older infants.[12,20] There is no significant risk of infection from bacteria released into the bloodstream from rectal examination or taking a rectal temperature. (The amount of bacteria released into the blood seems similar to that caused by a simple bowel movement: few enough that the body can clear them without difficulty.)[12,21,22] Some doctors believe that rectal examination or taking a rectal temperature may cause arrhythmias in a patient who has had a myocardial infarction. However, one large study showed that rectal exams are not likely to cause any problems in those with a recent MI.[23] Monitoring temperature is vitally important in the wilderness. If you have a patient with a possible myocardial infarction and possible hypothermia or heatstroke, obtain a rectal temperature if that is the only way you have to check the core temperature.

(3) Some suggest that placing a rectal temperature probe deep (15-20 cm.) within the rectum makes cold or warm blood from the lower extremities less likely to affect the readings.[24] However, we have not been able to find any evidence to support this idea. One study showed little effect of the depth of the rectal probe.[8] Placing the thermometer in about 5-10 cm (2-4 inches) seems appropriate for most situations.

f. **Tympanic (eardrum) temperatures**

(1) Tympanic (eardrum) temperatures are closer to rectal temperatures than are oral temperatures.[25] They also seem to measure temperature better than oral or rectal temperatures,[4,26] but may vary somewhat from the "true" core temperature. (As noted above, rectal temperatures might be falsely elevated in exertional heatstroke, due to excessively hot blood from active leg muscles. A tympanic temperature would be an excellent choice in such a situation. In an animal model of nonexertional heatstroke, tympanic temperatures were as reliable as rectal.[27]) Some early studies questioned their reliability.[28,29] However, newer studies show these thermometers seem to be accurate in older children and adults.[30] One study found that tympanic temperatures were not reliable in infants under three months of age possibly due to infants' small external ear canals.[31] Another study showed tympanic temperatures to be unreliable under the age of three.[32] Modern tympanic thermometers rely on the infrared radiation from the eardrum, and are quick and reliable. Middle ear infections (otitis media) have no significant effect on their accuracy.[33] Indoors, cerumen (earwax) has no effect on their accuracy.[31] The thermometer must be aimed correctly at the tympanic membrane to work correctly.[31,34,35]

(2) A tympanic membrane thermometer might seem ideal for wilderness rescue. A variety of models are now available.[36] However, there may be problems using them in the wilderness. Even for an ear thermometer that is designed to compensate for surrounding air temperature, one study showed tympanic temperature is increased by 0.7°C by exposure to a warm environment (95°F=35°C); for its test of a "cold" environment, this study chose 65°F (18.3°C), which had no effect on tympanic temperatures. However, the study did not look at the range of temperatures experienced in wilderness rescue.[14] Manufacturers indicate that their ear thermometers are only accurate in a controlled room temperature.* In a very hot environment, it is reasonable to expect that very warm blood flow from the scalp and face might make the external part of the ear canal very hot, which might increase the reading on the thermometer. In a very cold environment, even if the thermometer can compensate for the air temperature, it is reasonable to suspect that cold cerumen (earwax) in the ear might cause an inaccurately cold reading.

(3) Exergen Corporation's Ototemp™ model 3000-SD is specially designed for the rigors of the wilderness environment including a special coating on the internal circuit boards, and will detect a wider range of patient temperatures than the others (65°-130°F); it is rated to operate at ambient temperatures from 32°F (0°C) to 130°F (52°C).** (For temperatures below freezing, you would need to keep the thermometer inside your parka and only bring it out when you need to use it.) This company's

* IVAC Core*Check model 2090: 65°-90°F; Thermoscan models Pro-1 and HM-1: 61°-104°F; Intelligent Medical Systems FirstTemp 2000A and Genius 3000A: 60°-110°F; Diatek model 7000: 64°-104°F.

** Exergen Corporation; One Bridge Street; Newton, MA 02158; 1-800-422-3006; (617) 527-6660.

tympanic thermometers are designed to "focus" more narrowly on the eardrum itself than others, which eliminates (or at least markedly decreases) the effects of air or external ear canal temperature.[19] (Some other infrared tympanic thermometers rely on an "offset" correction factor to correct for the effects of a cooler external ear canal temperature. Because of varying external ear temperatures, the need for this correction makes such thermometers less accurate. This "offset" correction factor would likely not be correct in a wilderness patient.) Even with a device such as the OTOTEMP™ 3000-SD, an ear full of cold cerumen might cause a reading to be falsely low. Nonetheless, tympanic temperature, if measured by a device such as the Ototemp™ 3000-SD, seems to be the best method to evaluate for heatstroke or hypothermia in the wilderness.

g. An **esophageal thermometer** lies right behind the heart and is an ideal way to measure temperature, but must be placed in much the same way as a nasogastric tube. (However, some esophageal thermometers are smaller and easier to place than NG tubes.) Esophageal temperature seems to be the most reliable indicator of the core temperature. However, the thermometer must be accurately located in the esophagus to be accurate; temperature differences of up to 6°C may occur along the length of the esophagus.[10] To our knowledge esophageal thermometers have not yet been used in wilderness rescue.

3. For rectal, oral, or axillary temperatures, there are several types of thermometer you may carry and use in the wilderness.

a. A standard **glass-mercury thermometer** (or sometimes, glass with red-dyed alcohol instead of mercury) is a standard part of most wilderness first aid and medical kits. Wilderness enthusiasts are generally careful to obtain low-reading "hypothermia" thermometers, because not all thermometers will register hypothermic-range temperatures.

(1) The common perception that metallic mercury is poisonous is not true. Metallic mercury is not at all toxic compared to its soluble salts, which are the source of most mercury poisoning.

(2) However, glass thermometers are fragile. Even well-padded and packed deep in the bowels of a medical kit, they seem to have a propensity for emerging in shards and little silver globules just when needed the most.

(3) Even without fracturing, glass thermometers may be damaged by shocks, or by excessive heat or cold; in such cases, the mercury column becomes "dislocated" from its proper position. At home this can sometimes be cured by applying heat or cold to the thermometer, but fixing the thermometer in the wilderness can be time-consuming or impossible.

(4) Glass thermometers, as ordered from hospital suppliers, are not all accurate. Even when stored in a controlled room temperature, many become inaccurate over an eight month period.[37]

(5) In the mouth, a glass thermometer takes about three to five minutes to register its peak reading. In the axilla, however, it may take up to ten minutes.[38] The best way to be sure that you've measured the temperature accurately is to check the thermometer every few minutes, until you get two readings in a row that are the same.[38]

(6) To prevent cross-contamination, hospitals and clinics using glass thermometers generally have disposable lubricated covers to place over the thermometer. Because of small holes in the thin plastic sheath, they are not a reliable way to prevent cross-contamination. Sterilizing a glass thermometer between uses is appropriate, but may be difficult in the wilderness.

b. **Disposable paper and plastic thermometers** rely on a change in color with temperature. They are commonly applied to the forehead. (See the comments on skin temperature, above.) These skin thermometers have sometimes been found accurate in the controlled room temperature of the operating room or recovery room, with patients who are under or recovering from the effects of anaesthesia.*[39] Some are available for oral use. The forehead version is significantly affected by the surrounding air temperature. Such thermometers generally must be kept at a controlled room temperature (rarely available in the wilderness), or the colors may undergo irreversible changes. They have a short shelf life, even at controlled room temperature. They are not a good choice for wilderness medical kits.[11,40]

c. **Electronic single-reading thermometers**, either a dual oral/rectal unit or a tympanic membrane unit, are the standard in most hospitals. These units are relatively accurate, sturdy, and dependable. However, most are have rechargeable internal batteries, and for wilderness use, they should be adapted for disposable alkaline or lithium batteries.

d. **Continuous-reading thermometers** with remote monitor units are very useful during wilderness evacuations. Commercial units are expensive, but you can improvise a continuous remote-reading by using an inexpensive electronic indoor-outdoor thermometer.** The thermometer unit itself contains a battery that is sensitive to extreme cold, so it may be placed in the packaging with the patient, and brought out for periodic checks.

P. Monitoring

1. **Monitoring interval:** There are no absolute intervals to perform rechecks, or what to check (except as provided by Wilderness Command Physician's orders). The more unstable the patient, the more often you need to recheck vital signs. As a general rule, you should note level of consciousness, BP, pulse, temperature, respiratory rate, breath sounds, urinary output, IV and PO input, and any specific exams indicated by the illness or injury. (E.g., check a leg for developing compartment syndrome, or recheck the abdominal exam.)

2. **EKG monitors:** EKG (electrocardiogram) monitors have a poor weight-to-usefulness ratio for wilderness rescue, but are useful when first finding patients with severe hypothermia versus death.

* Patients under anaestheia have very different thermoregulatory responses than awake patients.

** Indoor-outdoor thermometers are available from Radio Shack and similar appliance stores for about twenty dollars each. The small outdoor temperature probe may be used as a rectal probe. These thermometers are only accurate to about a degree. However, this is adequate for a reasonable estimate of core temperature, and the thermometer will give an accurate reflection of whether the temperature is rising or dropping.

(This is discussed further in the *Cold-Related Problems* section.)

3. **BP cuff:** Automatic blood pressure monitors also have a poor weight-to-usefulness ratio. You can leave a manual BP cuff in place, tape a cheap stethoscope to the arm, and route the tubes to the outside of the patient packaging.

4. **Pulse monitors:** Pulse monitors that depend on a finger bloodflow sensor perform poorly with hypothermic patients due to peripheral vasoconstriction.

5. **Pulse oximeters:** Pulse oximeters are electronic devices that are attached to a finger, toe, or ear lobe. By monitoring the color of the blood perfusing the skin with each pulse, these monitors can give a real-time readout of the oxygen saturation of the blood. Pulse oximeters have been used in warm-weather simulated mountain rescue operations with success.[41] However, in severely hypothermic patients, pulse oximeters may reflect the oxygen saturation of a cold, cyanotic finger. This is not at all representative of the oxygenation of the core. Such a reading might lead to intervention that is not warranted (i.e., desperate attempts to provide an airway), or inappropriate actions (i.e., starting external cardiac compression). Use caution in interpreting pulse oximeter readings when the patient is cold. One study of open-heart surgery patients found that below skin temperatures of about 26°C oximeters were unreliable, though there was wide variation among the lowest reliable temperature in different subjects (20.3°C-37.7°C)[42] Another study also found that pulse oximeters over-estimated oxygen saturation just slightly in mildly hypothermic post-surgical patients, when they work.[43]

6. **Expired CO_2 Monitors:** Expired CO_2 monitors are rapidly finding favor to confirm proper endotracheal intubation. When an endotracheal tube is placed improperly (i.e., in the esophagus), little or no CO_2 will come out of the tube. An expired CO_2 monitor shows changes in color to indicate that it is sensing adequate amounts of expired CO_2. (Some show numbers instead.) However, due to slow metabolism, a severely hypothermic patient would rarely a positive reading on an expired CO_2 monitor, even if properly intubated.

7. **Urinary catheters:** Foley catheters or Texas catheters, with graduated bags to monitor urine output, are very useful in monitoring during a long evacuation. Along with physical examination of lungs, heart, and skin, urine output is a very good way to monitor a patient's fluid status. Urine output is a good measure of adequate tissue perfusion. If perfusion is inadequate, the kidneys shut down. For adults, 50 ml/hr is the minimum. For children, 1 ml/kg/hr is the minimum. (Details of using these devices are covered in *Orientation to/Review of Advanced Medical Skills* section. The differential diagnosis of decreased urine output is covered in the *Wilderness Trauma* section.)

8. Other potential monitoring devices include central venous pressure (CVP) manometers and arterial lines for arterial pressure monitoring. Arterial lines are finicky and difficult to use, and thus are probably not suited for wilderness use. Continuous CVP monitoring is unlikely to ever find a place in the wilderness, but briefly hooking up a manometer to a central IV line that is already in place would not be difficult, and might give useful information to the Wilderness Command Physician. (The technique is described in the *Advanced Skills* section. The interpretation of central venous pressure measurements is discussed in the *Wilderness Medical Problems* section.)

Glossary

Affect: Mood.

Basilar: Base, as in a basilar skull fracture at the base of the skull.

Battle's Sign: Retroauricular ecchymosis, suggesting a basilar skull fracture.

Coma Position: Left lateral decubitus position.

Costo-vertebral Angle: The part of the back lying on either side of the spine at the bottom of the posterior rib cage. Tenderness to a firm tap here suggests a kidney problem.

Crepitus: Grinding; usually of broken bones, irritated tendons, or air in the skin.

Decubitus Position: See Left Lateral Decubitus position.

Ecchymosis: Bruising.

EOMI: ExtraOcular Motions Intact. Means the patient can look left, look right, look up, and look down.

Flexed: Bent.

Gait: Walking.

Hemotympanum: Blood behind the eardrum (tympanum).

Hernia: An outpouching under the skin of abdominal contents, coming through a weak place in the abdominal wall.

Hyperreflexia: Increased deep tendon reflexes. Usually from damage to the brain or spinal cord.

Ileus: Absence of normal bowel activity.

Left Lateral Decubitus Position: Also known as the coma position. The patient is on the left side, with knees and hips slightly bent, and with the head on the flexed right arm, tilted slightly face down.

Otoscope: A special lighting device for looking in ears.

Pathognomonic: Absolutely diagnostic.

Pedal Edema: swelling in the ankles.

Perineal: Referring to the area behind the genitalia but in front of the anus.

Periorbital: Around the eyes.

PERL: Pupils Equal and Reactive to Light.

Pulse Oximeters: Electronic devices that are attached to a finger, toe, or ear lobe. By monitoring the color of the blood perfusing the skin with each pulse, these monitors can give a real-time readout of the oxygen saturation of the blood.

Pulse Pressure: The difference between systolic and diastolic pressures. For instance, if the BP is 120/80, the pulse pressure is 40. A narrowed pulse pressure, felt as a weak and thready pulse, is one of the early signs of shock.

Recurrent: occurring over and over.

Retroauricular: Behind the ears.

Retroperitoneal: Behind the peritoneum. The kidneys, pancreas, and parts of the intestine are retroperitoneal, rather than free in the peritoneal cavity of the abdomen.

Suppleness: When checking the neck, ability to move the neck in all directions without pain.

Tympanic Membrane: Eardrum.

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