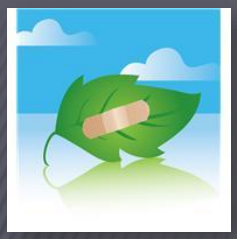
WEMR Supplement to the National Education Standards

WILDERNESS EMERGENCY FIRST AID

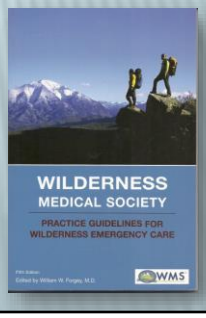


Section One

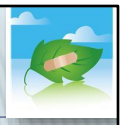
WILDERNESS EVACUATION CRITERIA

EVACUATION CRITERIA - WMS

- "The mode and urgency of the evacuation should be appropriate for the problem"
- Calling for on-site evacuation (e.g., helicopter) versus evacuating a patient to advanced care by foot or carried by litter is decided by using seven factors…

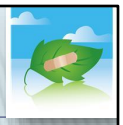


EVACUATION CRITERIA - WMS



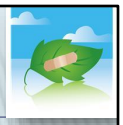
1. Severity of the illness or injury
   - + *Including the psychological condition of the victim*
   - × How long the victim will survive in the wilderness setting depends on six necessities of life:

SURVIVAL



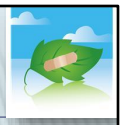
1. Food;
   - Can survive without for 3 weeks or more
2. Water;
   - Can survive without for 3 days in extremes
3. Rest;
   - Can survive without for 30 hours in extremes
4. Shelter;
   - Can survive without for 3 to 4 hours depending on the environment
5. Air;
   - Can survive without oxygen for 3-5 minutes
6. Positive mental attitude;
   - *Depends entirely on the person.*

EVACUATION CRITERIA - WMS



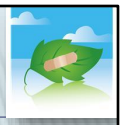
2. <u>Rescue skills and medical skills of the rescuers</u>
   - + That's why you are in this class
   - + You cannot give care that you do not know.

EVACUATION CRITERIA - WMS



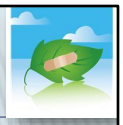
3. <u>Physical / psychological condition of the rescuers</u>
   - + It takes a lot of people, in really good shape, to complete a long litter evacuation, or up a steep slope, or out of the water, or just about anywhere else in the wilderness
   - + If YOU don't think you can make it – guess what, you won't.

EVACUATION CRITERIA - WMS



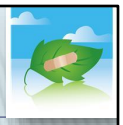
4. <u>Availability of equipment and/or aid for the rescue</u>
   - + Never focus on using just one “really good” way to evacuate
   - + The wilderness loves Murphy’s Law:
     - × The helicopter just won’t be available when you really need one
   - + Develop a Plan A, and a Plan B, and a Plan C
     - × *And start moving towards the road while you think of a Plan D….*

EVACUATION CRITERIA - WMS



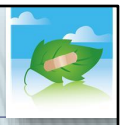
5. Danger / difficulty of extracting the victim(s) by the various means available
   - + Danger to who?
   - + Sometimes the longer route is the best route
   - + "KISS "– means…
     - × Keep
     - × It
     - × SAFE, and
     - × Simple.

EVACUATION CRITERIA - WMS



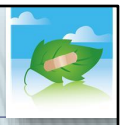
6. Time, a product of:
   - \+ Distance in the wilderness, (terrain, weather, and the possibility of deterioration of the weather), *and*
   - \+ Multiple other variables (such as the fire front)
   - × The best thing you can do is to make pre-plans BEFORE the incident happens.

EVACUATION CRITERIA - WMS



7. Cost
   - + Not necessarily monetary cost
   - + Helicopters are very expensive, yes, so don't ask for a flight for a hangnail
   - + However, also look at the other "costs" of evacuation":
   - + Time away from your assignment
   - + Personnel away from your assignment
   - + Safety of all people involved.

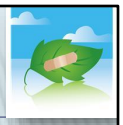
EVACUATION CRITERIA - WMS



WMS has two levels of evacuation:

- Urgent:
  - Considers that the patient's life or significant morbidity is at immediate risk
- Nonurgent:
  - For cases where the patient requires further evaluation and treatment but is not at immediate risk for significant morbidity or death
- Either way – don't wait.

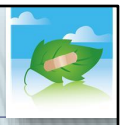
EVACUATION CRITERIA - WMS



Evacuation is recommended for patients with:

- Sustained, or progressive physiological deterioration:
  - Orthostatic dizziness (dizziness on standing)
  - Syncope (fainting)
  - Tachycardia
  - Bradycardia
  - Dyspnea (difficulty breathing)
  - ALOC
  - Return of a LOC following any head injury.

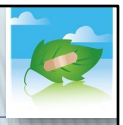
EVACUATION CRITERIA - WMS



Evacuation is recommended for patients with:

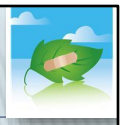
- Debilitating pain
- Inability to sustain travel at a reasonable pace due to a medical problem
- Sustained abdominal pain
- Infections that progress for more than 24 hours
- Chest pain
- Large or serious wounds or burns.

EVACUATION GUIDELINES

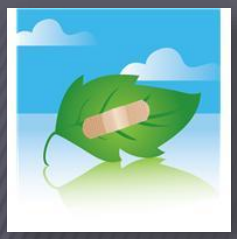


- If the decision has been made for a member to walk out to obtain definitive care, the individual MUST NOT go alone
  - At least two members who are mentally and physically equipped to do so, must accompany the patient.

EVACUATION GUIDELINES



- As we cover the specific medical and trauma chapters we will go over the specific evacuation guidelines .



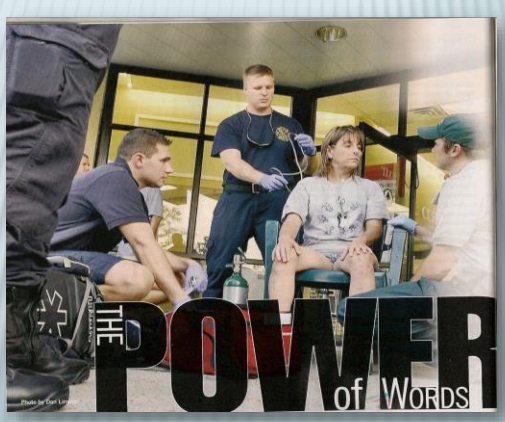
Section Two

VERBAL FIRST AID –

SOMETIMES IT'S ALL WE HAVE…

VERBAL FIRST AID

- **The First Contacts of Healing are the words you say (JEMS article).**



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VERBAL FIRST AID

- The 1970's Kansas Experiment:
  - A Kansas psychologist had medics say a short paragraph to patients
  - More of these patients survived (even the ones who were not expected to), they experienced shorter hospital stays and quicker recoveries:

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VERBAL FIRST AID

- "The worst is over. We are taking you to the hospital. Everything is being made ready. Let your body concentrate on repairing itself and feeling secure. Let your heart, your blood vessels, everything bring themselves into a state of preserving your life. Let the blood vessels close down so that your life is preserved. You are now in a safe position. The worst is over".

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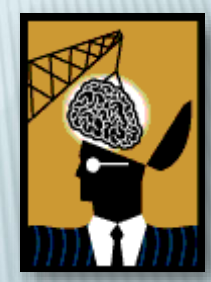
VERBAL FIRST AID

- The Healing Zone:
  - *why this works*
- The VFA Protocol:
  - *how to do it*
- Scripts for Specific Situations:
  - *what to say*.



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THE HEALING ZONE

- *Emergency* response of our body is either:
  - Fight
  - Flight
  - Freeze
- This is essentially an altered state of consciousness (ALOC)
- The brain is more receptive to suggestion
- An <u>opportunity</u> to make therapeutic suggestions
  - To get into the fourth state: ***<u>Flow.</u>***

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THE HEALING ZONE

- Our words can affect the autonomic nervous system
- They are accepted as commands
- Vital bodily functions can be controlled:
  - Heart rate
  - Bleeding
  - Blood pressure
  - Breathing
  - Perception of pain
  - Many more.

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THE HEALING ZONE

- "There are words and ways to say them that can mean the difference between panic and calm, pain and comfort, even life and death"
  - We can say nothing
  - We can say something harmful
  - We can say something helpful that will promote stabilization and healing.

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VFA PROTOCOL

- Verbal First Aid Protocol:
  - We Get Centered
  - We Establish Authority
  - We Give Therapeutic Suggestions
- *Prevent hijacking of the fore-brain by the mid-brain.*

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#1: CENTER YOURSELF

- We are at this emergency scene for a reason
- *Anxiety* is the major culprit in emergencies:
  - *Fight/flight/freeze makes you stupid*
- So: We are highly trained for just this emergency
- And we are constantly re-training.

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#2: ESTABLISH AN ALLIANCE

- *When someone is hurt, we are entering into that person's private sanctuary, respect it, reverence it…*
- ALOC produces more receptivity to suggestions (both good and bad):
  - Literal interpretation
  - Suspended disbelief
  - Selective awareness
  - Age regression.

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#2: ESTABLISH AN ALLIANCE

- Create authority:
  - "I'm here to help you"
- Communicate realistically:
  - "The worst is over"
  - Stick to the truth and lead into healing from there
  - You cannot say "everything's going to be all right" because it clearly isn't..

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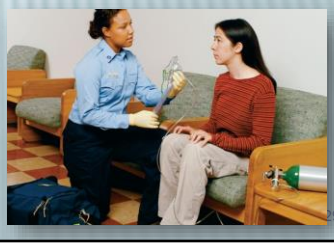
You cannot say "everything's going to be all right" because it clearly isn't. By saying the worst is over we give them the good news that the terrible incident is over – it has already happened – now comes healing.

#2: ESTABLISH AN ALLIANCE

- Solicit help:
  - Patient assessment is asking for their input, *but*
  - Can be taken a step farther:
    - "Now you can conserve your blood"
    - "Now you can begin to feel more comfortable"
    - "Now you can take a good deep breath"
    - "Now you can begin to relax".



With children – one person "bought" a child's headache with $5 –"it's mine now, you can't have it anymore"… the headache was gone.

#2: ESTABLISH AN ALLIANCE

- Get a "contract" if you can:
- The patient agrees to accept your authority
- It can be direct:
  - "Will you do what I say?"
- It can be indirect or simply understood even with a patient who is non-responsive:
  - "You *can* begin to use everything you've got to survive".

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#3: GIVING THERAPEUTIC SUGGESTIONS

- You now have the attention of your patient
  - They know you are here to help and that the ambulance is on its way
  - The next step is to build on this by *suggestion*
- "Patients survive, and heal, in part because they are given permission, or because they believe it is the expected outcome"
  - The opposite can happen too.

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We also know of the opposite happening: the power of a curse, the evil eye or voodoo – the victim believes that the suggestion is real, and it eventually works. This is the basis for over training – we do something over and over until it becomes automatic, we don't have to think about it. In an emergency, we can't take the time to think about what needs to be done.

#3: GIVING THERAPEUTIC SUGGESTIONS

- Suggestion is the "blueprint" for action
- The goal of suggestion is to stimulate images that initiate healing biochemical processes:
  - Can be literal images: a patient with a high fever can be instructed to imagine floating in a cool lake
  - Can be symbolic images: a patient with an uncontrolled bleed can be directed to imagine turning off a faucet.

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#3: BASIC RULES FOR SUGGESTIONS

- Say what you want to have happen. Not what you don't:
  - Avoid negative pictures "*Don't* die", "*Stop* bleeding", "*Don't* shoot"
- Avoid blame or anger
- Avoid words like "pain" and "hurt"
- Avoid the word "try" (implies failure).

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#3: BASIC RULES FOR SUGGESTIONS

- Begin with the easiest and work to more difficult suggestions:
  - Something you know the patient can do:
  - "I want you to sit in this chair first"
  - "Good. Now that you are sitting down, you can allow your body to feel more comfortable."

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#3: BASIC RULES FOR SUGGESTIONS

- Create positive expectation:
  - "I know that you can do this."

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#3: BASIC RULES FOR SUGGESTIONS

- Utilize imagination – both yours and theirs:
  - "Think of the best place you've ever been, imagine walking there, notice how relaxed you feel, your breathing is calm."

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#3: BASIC RULES FOR SUGGESTIONS

- Congratulate even minor successes and use them to achieve greater ones:
  - "Breathe deeply, great. Now, as we lift your leg allow your muscles to lengthen and relax."
- Suggestions should be clear and specific.

#3: BASIC RULES FOR SUGGESTIONS

- Suggestions should be believable:
  - "I can see your arm is injured, and as I now hold pressure on this bandage you can feel the bleeding slowing down and the clotting begin."

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In ALOC we hear things LITERALLY.

SPECIFIC THINGS TO SAY

- #1: Establish an Alliance:
  - "I'm a Wilderness First Responder and I'm going to help you"
  - "I'm here to help"
  - "It's okay, I'm here".

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SPECIFIC THINGS TO SAY

- #2: Get a Contract:
  - "Will you do what I say?"
  - "Will you come with me?"
  - "Will you let me help you feel better?"

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SPECIFIC THINGS TO SAY

- #3: Be Realistic:
  - "The danger is past"
  - "The worst is over".

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SPECIFIC THINGS TO SAY

- #4: Solicit Their Help:
  - "I'm going to help you, and to do that I need you to help me by scanning the rest of your body and telling me what else is going on. What about here?"

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SPECIFIC THINGS TO SAY

- "Let me see if I understand you correctly"
  - Paraphrase their words back to them
  - You are telling them that you are listening.

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SPECIFIC THINGS TO SAY

- "I can see why you might feel that way"
  - Empathy – you do not need to agree with them, but you shouldn't argue with them.

SPECIFIC THINGS *NOT* TO SAY

- *"Calm down"*
  - It is counterproductive
- *"Listen", "hey", "look", "wait", "but"*
  - These are interruptions – when we should be listening
- *"I promise"*
  - Remember – we cannot.

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SPECIFIC THINGS I HAVE SAID

- "*Breathe with me*"
  - Get your patient to focus on your/their breathing
- The "faucet" technique
- The "transfer " technique
- The "dial-o-meter" technique.

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SUMMARY

- It works
- It might be the only thing we have
- Think about when you might have to use it
- QUESTIONS on Verbal First Aid…

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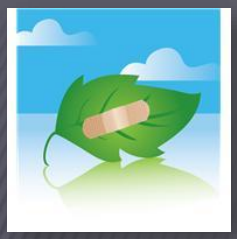
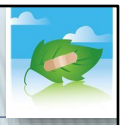


Section Three

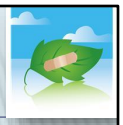
INITIAL PATIENT ASSESSMENT IN THE WILDERNESS: THE FIVE-SECOND ASSESSMENT

INITIAL ASSESSMENT REVIEW



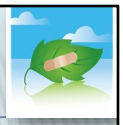
- Your ability to adequately and safely manage an emergency in the wilderness is rooted in your ability to properly assess the scene and the patient
- Patient assessment is the "meat and potatoes" of why we are here
  - The most frequently-used skill
  - It IS the basis from which ALL other decisions will be made.
- Good patient care is directly linked to good patient assessment
- THE most essential of all First Responder skills:
- *BLS saves lives.*

INITIAL ASSESSMENT



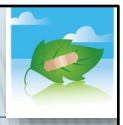
- *We are looking for trouble:*
- *Recognize, Prioritize, Communicate…*
- "What am I seeing, here?"
- "What will kill my patient *first*?"
- In the first FIVE SECONDS…

WHY ???



- *We have to immediately identify, and treat life-threatening conditions*
- Recognize life-threats in the first 5-10 seconds of on-scene patient contact:
- #1 – threats to yourself
- #2 – threats to your patient.

#1: THE SCENE SIZE-UP

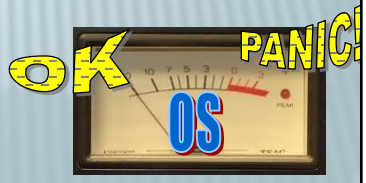


- Provides valuable information about safety of the scene and the MOI/Nature of Illness
- A quick, 360° assessment of scene and surroundings
  - Look up, look down, look all around
- Determines number of patients
- Determines need for additional assistance
- Consider the need for C-Spine Immobilization
- Take in the whole picture.

Oncoming traffic, unstable surfaces, leaking gasoline/diesel fuel, downed electrical lines, hostile bystanders or potential for violence from the patient(s), fire or smoke, possible hazardous or toxic materials, crime scenes.

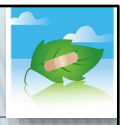
SCENE SIZE-UP, CONTINUED

- *Be suspicious – what happened here?*
- Ask the patient, team/crew members, bystanders, LE
- But any 'scene' is a dynamic entity, changing from minute to minute
- Learn to listen to your internal “OS Meter”.



Additional assistance might be SO, other First Responders, Air Ambulance, etc.

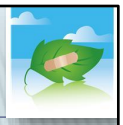
SCENE SIZE-UP, CONTINUED



- The initial reaction can lead to a sense that some immediate engagement in this scene is expected
- DO NOT GIVE IN TO THIS SENSE OF URGENCY!
- Your first action is NOT to run into this scene (as an Emergency Service Provider, you should not RUN anywhere,)
- *But to STOP*
- Take a nice deep breath and look around.

Additional assistance might be SO, other First Responders, Air Ambulance, etc.

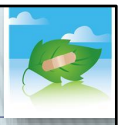
SCENE SIZE-UP, CONTINUED



- All of this "input" is intended to provide you with a platform from which to make a decision:
  - *"Do I enter the scene, or not? And, if so, what Personal Protective Equipment (PPE) will I need to bring with me?"*
- If the scene is found to be unsafe, for any reason, DO NOT ENTER IT, unless you can render it safe, or until it has been made safe by others.

Additional assistance might be SO, other First Responders, Air Ambulance, etc.

SCENE SIZE-UP, CONTINUED

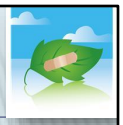


- After you have determined that the scene is safe, we do three essential procedures:

1. The Five-Second Patient Assessment
2. Bring Essential Equipment
3. Save Your Patient's Life.

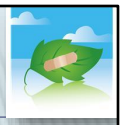
Additional assistance might be SO, other First Responders, Air Ambulance, etc.

#1: THE FIVE SECOND ASSESSMENT



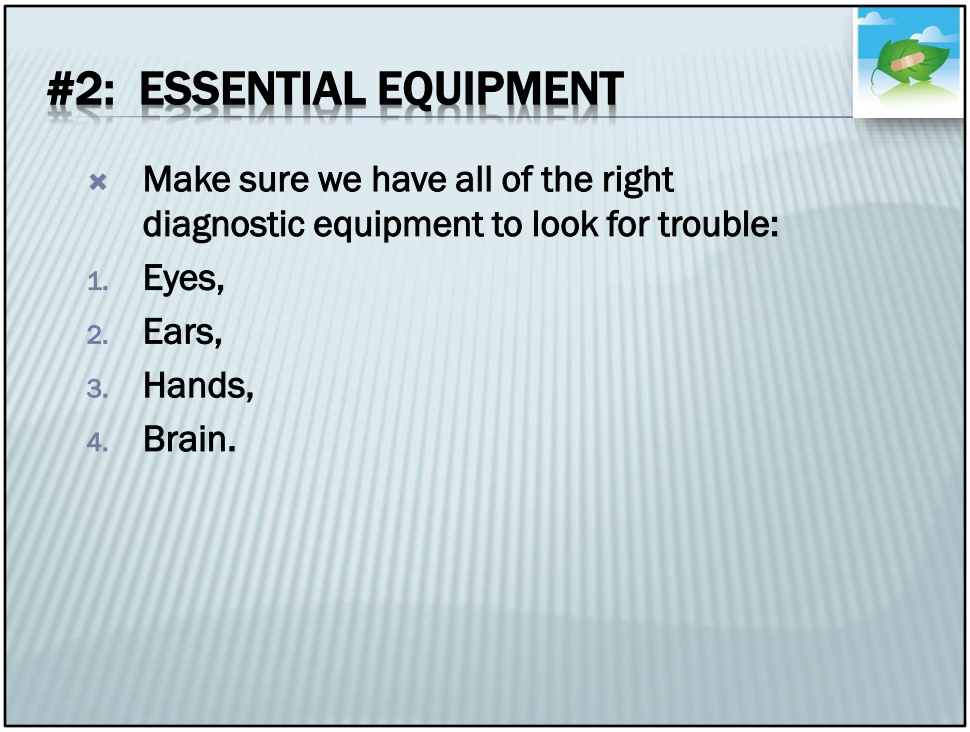
- Real-World General Impression:
- As you approach the patient, "look for trouble"…*and Prioritize*…:
  1. Look at the patient's body language
  2. Look at the patient's Level of Consciousness
  3. Look at the patient's breathing
  4. Look at the patient's skin signs
  5. Grasp the wrist, determine pulse and skin temperature and moisture.

#1: THE FIVE SECOND ASSESSMENT



- In the *first 5 seconds* you have determined:

1. <u>Immediate</u> life-threats:
    1. Cardiac arrest?
    2. Major bleeding?
    3. Shock?
2. ABC's:
    1. Airway open?
    2. Breathing adequately?
    3. Detectible radial pulse?
3. Level of consciousness:
    1. AVPU level.

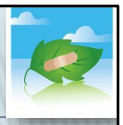


BLS saves lives. BLS is looking for the life-threats, not really a function of ALS. We need to keep asking "what will kill my patient FIRST".

#3: HOW TO SAVE YOUR PATIENT'S LIFE

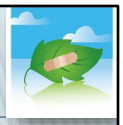
- *BLS Saves Lives…*
  - We stop the bleeding
  - We start the heart pumping
  - We open the airway
  - We keep the oxygen flowing
  - We get the patient out of immediate danger
  - We splint the limbs
  - We keep the C Spine straight
- *We Look For Trouble – what will kill my patient FIRST.*

#3: HOW TO SAVE YOUR PATIENT'S LIFE



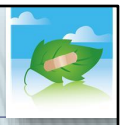
- Ask:
- What Will Kill My Patient FIRST?
  - Shock
  - Hypoxia
  - Hypoglycemia
  - Dehydration
  - Multi-system trauma
  - Co-morbidities (medical with trauma).

#3: HOW TO SAVE YOUR PATIENT'S LIFE



- Patient assessment is like a detective story:
- We have to ask the right questions, and keep digging for the right answers
- If what you are seeing does not match with what you are told, keep digging
- Sophisticated diagnostic equipment can be of enormous benefit in the field, however…
- Just paying attention, asking the right questions, and using your "own" tools, you can actually learn quite a lot about your patient.

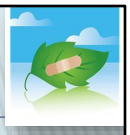
ASSESSMENT IN THE WILDERNESS



- A – airway
- B – breathing
- C - circulation (and bleeding)
- D – disability (and level of consciousness)
- E – environment / exposure.

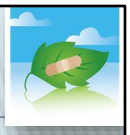
- In this order, and do it over and over…
- Any compromise in one of these means you have a critical patient.

WILDERNESS VITAL SIGNS



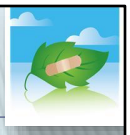
- Skin color , temperature and moisture are extremely important signs:
  - Hot, dry, flushed (heat emergency?)
  - Pale, cool, clammy (shock?)
  - Blue or pale (not enough oxygen)
  - Blotchiness (hives from an allergic reaction)
  - Red streaks (severe infection)
  - Skin turgor (demonstrating dehydration)
- In the wilderness – don't just document these findings – chase them down and find out WHY.

WILDERNESS VITAL SIGNS



- In the wilderness the *second* set of vitals is often more important than the first;
  - *And the third more important than the second*
- Never isolate one vital sign – take them as a whole
- Have the same rescuer do the vitals if possible
- LOR, pulse, respirations and most skin signs will change *early;*
  - Blood pressure, pupils and skin temperature will change later.

WILDERNESS VITAL SIGNS



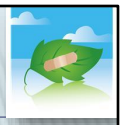
- *Blood pressure without a cuff:*
- If you can feel the pedal pulse the blood pressure is at least 90 mm Hg systolic
- If you can feel a pulse at the radial artery the blood pressure is at least 80 mm Hg systolic
- If you cannot feel the radial pulse, but can feel the femoral or brachial pulse the blood pressure is about 70 mm Hg systolic
- If you can only find the carotid pulse the blood pressure is about 50-60 mm Hg systolic.

If you cannot feel a radial pulse you have a CRITICAL patient. Just where are these pulse points?

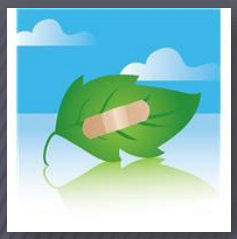
THINGS THAT AREN'T WRITTEN IN SOME DANG PROTOCOL…

- Protocols are written to standardize care
- The detailed steps to be followed in treating a patient
- But, they don't tell us how to *treat* the patient…

SO…TO SUMMARIZE…



- Look for trouble:
- Recognize priority patients - conditions affecting consciousness, breathing or circulation
- Prioritize those conditions – take care of the most life-threatening FIRST
- Communicate to your patient and to others
- Be a Patient Advocate.



Section Four

SEARCH AND RESCUE FOR THOSE WHO ARE NOT IN SEARCH AND RESCUE

OBJECTIVE

- At the conclusion of this class, the EMR/EMT will:
  - Have a basic understanding of lost person behavior
  - Know how to properly package a victim
  - Know how to safely evacuate a victim
  - *Be familiar with the special medical and trauma problems associated with rescue situations.*

WHAT IS SEARCH AND RESCUE?

- *"The act of finding and returning to safety the survivors from an emergency incident"*
- "SEARCH" is an operation using available personnel and facilities to locate persons in distress
- "RESCUE" is an operation to retrieve persons in distress, provide for their initial medical needs, and deliver them to a place of safety.

WHAT IS SEARCH AND RESCUE?

- Search skills
- Rescue skills
- Support skills
- Medical support.

#1. SEARCH OPERATIONS:

LOCATE PHASE

REACH OPERATIONS

LOST PERSON BEHAVIOR

- Children 1-3 years
- Children 4-6 years
- Children 7-12 years
- Elderly persons (over 75 years)
- Alzheimer's patients
- Despondent / Suicidal
- Hikers / Hunters.

CHILDREN 1-3 YEARS

- Unaware of the concept of “being lost”
- Navigational skills and sense of direction are non-existent
- They will have no idea how to get back to the point last seen or how to return home
- They will probably wander aimlessly without an objective
- They are unlikely to respond to searchers.

CHILDREN 1-3 YEARS

- They are likely to find somewhere to lie down and sleep
  - Such as in thick bush, under a rock, picnic table or somewhere else they may find or perceive to be shelter
- They will be attracted / drawn away by the sight of an animal
- They will seek shelter in poor weather
- They are inquisitive.

CHILDREN 1-3 YEARS

- They will not travel great distances
  - *...but due to their size and reluctance to respond to searchers, very thorough searching is required*
- In good weather 90% were easily detected
  - 10% found shelter
- In bad weather 75% were easily detected
  - 25% had found shelter to protect themselves.

CHILDREN 1-3 YEARS

- 57% used paths or tracks or followed a route which afforded least resistance
- 43% were found in areas of overgrowth/bushes/thickets
- 89% were found within 2 miles *downhill from their last known position.*

CHILDREN 4-6 YEARS

- These are more mobile and capable of going further than those in the 1-3 category
- They do recognize the concept of being lost and will generally try to return home or go back to a place with which they are familiar
- They have definite interests and may be drawn away by animals, follow older children or just explore.

CHILDREN 4-6 YEARS

- When tired they will try to seek shelter or somewhere to sleep at nap time, when it becomes dark or weather worsens
- Many children will have been instructed to stay away from strangers and will not therefore be likely to respond to searchers calling their name (especially men)
  - However, after a prolonged period of being lost fear of darkness or other fears will overcome their fear of strangers and they will gladly respond to their name.

CHILDREN 4-6 YEARS

- 43% were found in areas of overgrowth/bushes/thickets
- 65% were found within 1 mile of LKP
- 87% used paths or trails
- *56% go downhill from their last known position.*

CHILDREN 7-12 YEARS

- May intentionally run away if mad, or to avoid punishment, or gain attention
- May not answer until cold/hungry
- Similar fears as adult, only enhanced - greater sense of fear/loneliness/helplessness
- Navigation & direction skills much more developed
- Often lost as a result of being placed in a strange environment by adults
- Often will not answer when called, darkness usually brings on a willingness to accept help & be found.

CHILDREN 7-12 YEARS

- 87% used paths, trail
- They will remain on a particular path/track which may take them a long way from the PLS or LKP
- 93% found within 2 mi
- 33% go upwards
- 58% go downwards.

ELDERLY > 75 YEARS

- If in good health they are capable of traveling as far as younger subjects undertaking the same activity
- Elderly persons behave more rationally than the young
- They are more willing to build a shelter and aid in their own rescue
- Their orientation could be to their own past rather than their own present.

ELDERLY > 75 YEARS

- Many pose the same supervision problem as young children
- The more active ones are likely to exhaust themselves rapidly which may result in illness such as a heart attack
- Pre-existing medical concerns may also cause problems
- They may have problems associated with being old such as being deaf and unable to respond to searchers.

ELDERLY > 75 YEARS

- 52% were found within a 1 mile radius
- 10% go upwards
- 70% go downwards.

ALZHEIMER'S PATIENTS

- Poor memory even in early stages
- Reasoning power is impaired so they may walk across roads and back into their surrounding terrain
- They are oriented to the past and their degree of disease will send them back in time
- They will start to travel along roads when leaving a place of residence
- If the subject isn't on a road they will usually be in a creek/drainage and/or caught in vegetation/overgrowth
  - They will simply go until they get stuck so they are very difficult for searchers to find.

ALZHEIMER'S PATIENTS

- They appear to lack the ability to turn around; They travel in straight lines
- They will be found a short distance from roads but will cross roads when moving
- *They will not cry out for help*
- Many will try and return to a former residence, workplace or a favorite location
- They may have a previous history of wandering
- Existing medical ailments will limit their mobility
- Search heavy undergrowth/bushes/thickets; Remind searchers frequently about this important aspect.

ALZHEIMER'S PATIENTS

- Usually found within half a mile from point last seen and rarely, if ever travel further than 1.5 miles from PLS
- The majority of subjects in this category will succumb to the environment (hypothermia/dehydration) and will require medical help, evacuation or they will be deceased.

ALZHEIMER'S PATIENTS

- Searches for this type of subject should be considered extremely urgent:
  - If not found immediately will almost certainly be deceased within 24 hours, or even less in bad weather
- They are extremely hard to detect because they are usually hidden in dense vegetation
  - 48% were found in creeks, drainage thick brush or dense cover.

DESPONDENT / SUICIDAL

- Despondents will act in one of two ways:

1. Most will be seeking to get just out of sight. 50% are found within 0.2 miles of PLS
2. Subjects may seek out a specific scenic location, often significant in their life history

- Most are not actually lost but will be seeking solitude where they can be alone and contemplate suicide and/or philosophize about life generally
  - *They will not be far away from the home or vehicle.*

DESPONDENT / SUICIDAL

- They will generally not respond to searchers and will even hide
  - *They will actively evade searchers*
- They will generally be within sight and sound of civilization
  - They are usually close enough to be heard (should they really need help)
- Extremely high fatality rate. They will rarely take steps to protect themselves from the weather
  - Drugs and alcohol may be involved
  - Consider whether they have the means to harm themselves or someone else.

DESPONDENT / SUICIDAL

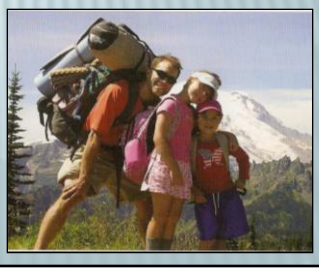
- They tend to be found near prominent locations:
  - Lake or scenic hill
  - A high point with a view
  - Frequently at the junction of two types of terrain, (field and woods, for example)
  - Seldom, if ever, found in overgrowth or thickets
- *They will tend to travel upward to a distinctive location*
  - *33% located in open woodland, sometimes above heads of searchers.*

DESPONDENT / SUICIDAL

- *This category of search should be considered very urgent*
- The subject, if found alive, may require medical attention
- Despondents have a very high mortality rate (>55%)
- Older males in this category have the highest mortality rate of all (>75%).

HIKERS

- Hikers tend to travel much further due to their reliance on trails and tracks
- Some hikers can lack experience and be poorly prepared and equipped
- Complications when tracks/paths change or become obscure: poorly defined junctions, snow covering, poor visibility conditions
- The weakest may fall behind, become disoriented and then lost
- *54% went downhill.*



HUNTERS

- Hunters tend to concentrate on the game, not the navigation
- Tend to overextend into dark and push beyond physical abilities
- Often try to take “short cuts”
- Tendency to follow game to dense underbrush or deep snows, deadfall areas, boulder fields, etc. with little regard for exhaustion or navigation
- Often only prepared for the day
- 82-90% found within 5 mi of PLS.

LOST PERSON BEHAVIOR SUMMARY

- Most age groups go downhill (usually towards the sun)
  - *But Despondents will go UP*
- Children, despondent subjects and Alzheimer's patients will NOT respond to searchers
- Most will usually stay on a trail;
  - But the Alzheimer's patients will NOT.

#2. MEDICAL STABILIZATION PHASE:
PATIENT ASSESSMENT
BLS PATIENT STABILIZATION

PATIENT RESCUE OPERATIONS

- In stabilization:
  - *The big difference between backcountry trauma BLS and frontcountry trauma BLS is the exposure to the environment and the potential length of time spent in the pre-hospital setting of evacuation.*

PATIENT RESCUE OPERATIONS

- *Essential to BLS rescue operations:*
  - Aggressive airway management
  - C-spine stabilization until 'cleared'
  - Recognition of the unstable patient and possibility of shock
  - Vigilant monitoring of patient vital signs (HR, RR, SCTM, LOR)
  - Careful patient packaging
  - Rapid evacuation.

GENERAL PATIENT ASSESSMENT

- A = Airway takes priority over all other problems
  - Can you perform adequate suctioning and oxygen delivery?
- B = Breathing - Regulate oxygen flow to avoid waste;
  - D Cylinder holds ≈ 315 Liters of oxygen:
    - @ 15 lpm ≈
    - @ 3 lpm ≈

21 minutes
105 minutes.

GENERAL PATIENT ASSESSMENT

- C = Circulation - CPR is of little benefit in remote locations
  - Exceptions are cold-water immersion and lightning strike
- C- Spine - Realize that C-Spine immobilization means the patient is non-ambulatory and will require more manpower and equipment for evacuation; do a focused spinal assessment it if you can.

GENERAL PATIENT ASSESSMENT

- D = Disability - establish level of consciousness:
  - AVPU, and
  - Person, Place, Time, Event
- Watch closely!
  - Monitor over time – even after the patient has been found/treated/packaged
  - If the LOR changes – *it probably means shock.*

GENERAL PATIENT ASSESSMENT

- E = Environment - Insulate patients from the ground up to protect against heat loss
- E= Expose - Avoid "poor patient examination" because of clothing:
  - Especially in the chest and abdomen
  - Visualize ALL injuries completely
  - Then cover them back up again
- *Hypothermia is our most frequent problem*.

PATIENT STABILIZATION

- *REMEMBER:*
  - In the wilderness environment medical over-sophistication gives way to practicality and improvisation
  - *Success or failure of initial basic life support provided at the scene of the event is the most important determinant of outcome.*

PATIENT STABILIZATION: METABOLISM

- Shock Management:
  - ANTICIPATE SHOCK!
  - Handle the patient gently and utilize verbal first aid (encourage a positive mental attitude)
  - Act deliberately and with confidence
  - Your *calm attention* may be the only thing that keeps your patient alive.

PATIENT STABILIZATION: FRACTURES

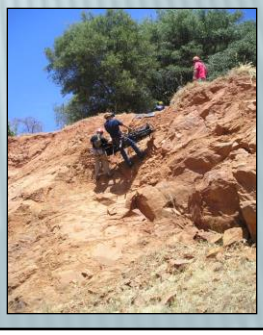
- Assessment: *Look, Ask, Feel*
  - Looking requires careful removal or cutting away clothing
  - Compare the injured with the non-injured side/leg/arm
  - Look for bruising, bleeding, deformity or lack of symmetry, guarding or over protectiveness by the patient.

PATIENT STABILIZATION: FRACTURES

- Assessment: *Look, Ask, Feel*
  - Asking starts with finding out what happened and the forces involved
  - Ask about pain – where, how much
  - Ask about sounds – snaps or pops when the injury occurred.

PATIENT STABILIZATION: SPINE/HEAD TRAUMA

- Treatment:
- "For backcountry trauma patients who have survived long enough to be rescued, the incident of unstable spine injury will be less than 1%".



SPECIAL TRAUMA SITUATIONS

- *Impaled Objects:*
- Remove objects that interfere with safe transport or will cause more damage if left in place
- Remove all impaled objects unless doing so would cause further harm
- Exceptions include impaled objects in the globe of the eye or when removal would result in severe pain or bleeding
- After removal, treat as an open wound.

#3. EVACUATION PHASE:
PATIENT PACKAGING
TRANSPORT

PATIENT PACKAGING

- The packaging depends on:
  - The medical/trauma condition
  - The environment
  - The manner of evacuation
- *The less "give" in the packaging, the more comfortable will be the ride for your patient.*

LITTER TRANSPORT

- Rescuer on head is in charge
- Before lift, ask “is anyone not ready?”
- Have enough people to clear trail/rotate out
- Straps/webbing to adjust height of carriers
- Snow travel: webbing/ropes to help pull.

LITTER TRANSPORT

- Transport supine patients with the head *uphill*:
  - Head downhill increases ICP
  - Limits diaphragmatic expansion
  - Increases the chance for vertigo
  - Unconscious patients may aspirate gastric contents.

LITTER TRANSPORT

- Over very rough terrain, use the caterpillar pass
- On steep hills, a safety line hauled from the front of the litter might help the litter carriers
- *Be careful*:
  - Carrying patients in the backcountry is extremely difficult, time consuming and dangerous activity for both the patient and those doing the carrying.

LITTER TRANSPORT

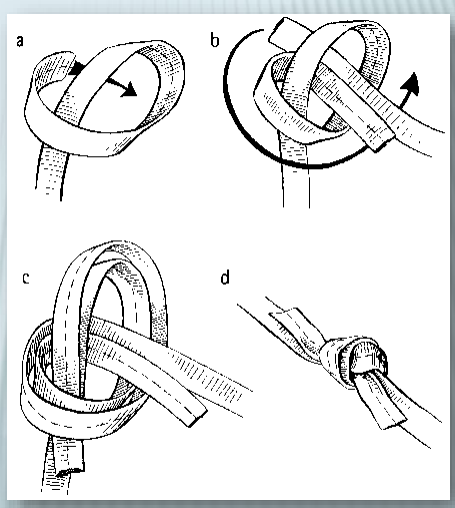
- For a good anchor/pulley:
- Wrap Three Pull Two:
- 25 foot webbing around a large tree, wrap three times and tie a water knot
- Pull two of the wraps and attach a Carabiner.

LITTER TRANSPORT

- Wrap Three Pull Two.

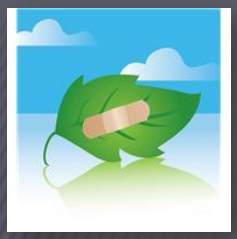
LITTER TRANSPORT

- Water knot.



SUMMARY

- You may have to evacuate your patient in very difficult circumstances
- Also, your duties may include assistance to Search and Rescue
- By increasing our knowledge and skills we can be of even more value to our patients when we are called to help.



Section Five

ENVIRONMENTAL IMPACT

Texas, July 2011

THE CASE OF CALEB HAMM

THE CR 337 INCIDENT: OVERVIEW

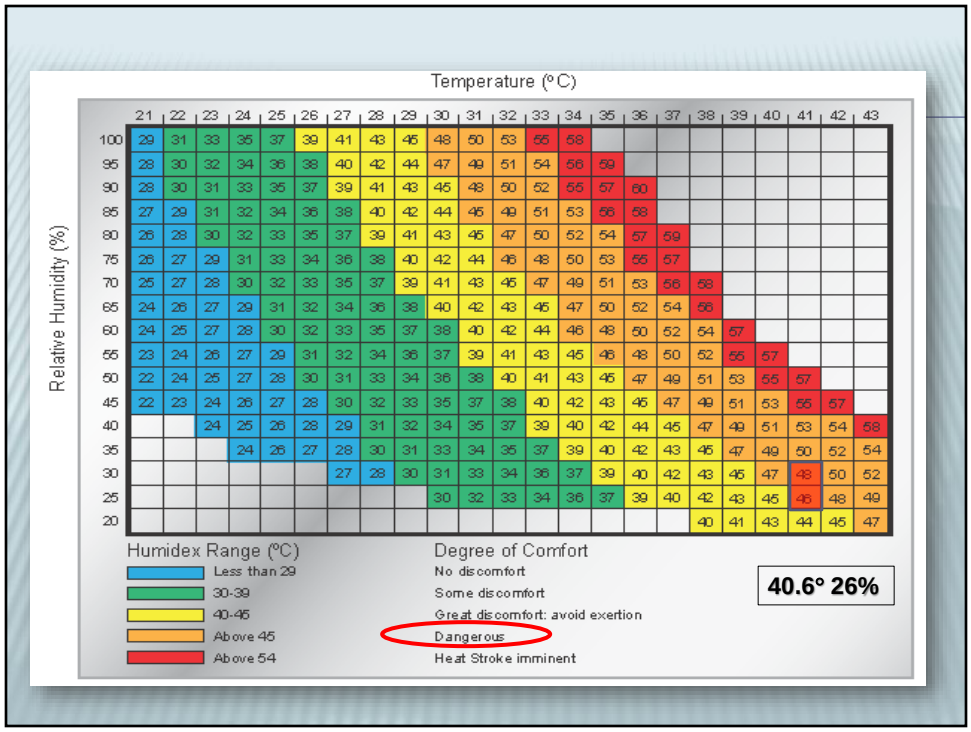
- On July 7, 2011, Caleb Hamm, crewmember of the Bureau of Land Management (BLM) Bonneville Interagency Hotshot Crew (Bonneville IHC) was working in Division A of the CR 337 (County Road 337) fire, near Mineral Wells, Texas, when he collapsed and subsequently died.

THE CR 337 INCIDENT: OVERVIEW

- On July 6, 2011, the Bonneville IHC began the operational period at 0600 hours at Abilene, Texas, and was assigned and enroute to the CR 337 Fire
- Each crewmember was required to carry a minimum of six quarts of water during the work shift
- Caleb Hamm was from Boise, Idaho.

THE DAY OF THE INCIDENT; JULY 7, 2011

- On July 7, 2011, the Bonneville IHC began its shift at 0730 hours
- Safety items covered were Haines Index 6, high temperature of 105° F (40.6° C), relative humidity 18-26% and possible dry lightning.


Temperature (°C)
Relative Humidity (%)
Humidex Range (°C)
Less than 29
30-39
40-45
Above 45
Above 54
Degree of Comfort
No discomfort
Some discomfort
Great discomfort: avoid exertion
Dangerous
Heat Stroke imminent
40.6° 26%

THE DAY OF THE INCIDENT: JULY 7, 2011

- On July 7, 2011, the Bonneville IHC began work at 0900 hours in Division A on the CR 337 fire
- The crew's operational assignment for that shift was to continue to construct fireline, cold trail, and mop up.

THE DAY OF THE INCIDENT: JULY 7, 2011

- Hamm was assigned to swamper duties on a saw team, which he performed until about an hour before lunch (for about three hours)
- He asked to take a break from swamper duties and was swapped out with another crewmember
- At that point, he was assigned to help cold trail with a hand tool.

THE DAY OF THE INCIDENT: JULY 7, 2011

- At about 1300 hours, the Bonneville IHC completed fireline construction by tying into fireline constructed by Big Bear Interagency Hotshot Crew (Big Bear IHC) coming from DP 5
- The Bonneville IHC broke for lunch and resupplied water canteens with extra water.

THE DAY OF THE INCIDENT: JULY 7, 2011

- Lunches were delivered at 1330, and a Bonneville crewmember brought lunches to the crew
- Lunch break was 30 to 40 minutes
- The crewmembers were together in the general area at lunch
- Neither Hamm nor other crewmembers gave any indications of any problems at the lunch break.

THE DAY OF THE INCIDENT: JULY 7, 2011

- During the lunch break, Hamm was observed eating lunch and interacting in conversation with other crewmembers
- After lunch(1405-1410), the Bonneville IHC topped off canteens from the banjos
- The squad leaders advised the Bonneville Assistant Superintendent that only 1½ banjos out of 15 still had water .

THE DAY OF THE INCIDENT: JULY 7, 2011

- 1530-1550: About 20 minutes before the accident, the Bonneville Assistant Superintendent stopped and talked to Hamm for a couple of minutes and said he was completely lucid and did not appear to be fatigued
- Crewmembers split into pairs to cold trail and follow the fire's edge around an unburned finger.

THE DAY OF THE INCIDENT: JULY 7, 2011

- 1545: The Squad C lead crewmember, who was working with Hamm, asked if he was okay after Hamm stumbled on a rocky slope while hiking down the drainage (after working for about one hour, forty minutes)
- Hamm said he was hot, with a little headache
- Squad C lead crewmember advised Hamm to sit down in the shade and take a break *if needed"*.

0:00

THE DAY OF THE INCIDENT: JULY 7, 2011

- Squad C lead crewmember told Hamm he was going to tie in with crewmembers from Squad B who were working on the other side of the unburned finger and he would be right back.

0:01

THE DAY OF THE INCIDENT: JULY 7, 2011

- Squad C lead crewmember was gone *about two to three minutes* before returning to Hamm's location
- 1550: When Squad C lead crewmember returned, he found Hamm collapsed on the rocks and unconscious.

0:05

THE DAY OF THE INCIDENT: JULY 7, 2011

- 1553: The Squad C lead crewmember called the Bonneville Assistant Superintendent on the radio to report Hamm was down
- The Assistant Superintendent immediately came down the hill, about one minute to accident site
- Crew EMT#1 heard the radio traffic that Hamm was down and started moving that way
- 1555: Crew EMT#1 arrived and found Hamm wedged in the rocks with legs dangling.

0:10

THE DAY OF THE INCIDENT: JULY 7, 2011

- When he got closer to Hamm, he heard labored breathing but noticed Hamm's respiratory rate was within normal parameters
- Crew EMT#1 initiated patient assessment
- Although EMT#1 suspected heat injury, he was unsure of the exact cause of Hamm's unconsciousness.

0:10

THE DAY OF THE INCIDENT: JULY 7, 2011

- Hamm was unresponsive to voice prompts, but Crew EMT#1 did a sternum rub and Hamm was semi-responsive to pain
- Crew EMT#1 ordered a crewmember to get the backboard, oxygen, and trauma kit from crew truck and requested Crew EMT#2 to come to the accident scene…

0:11

THE DAY OF THE INCIDENT: JULY 7, 2011

- The Crew Superintendent heard radio traffic of the conversation between Squad C lead crewmember and the Assistant Superintendent, and relayed to Air Attack that there was a medical emergency and requested Advanced Life Support to DP 20
- The Air Attack notified Operations Chief A by radio that Bonneville IHC had a crewmember down with what appeared to be heat-related problems.

THE DAY OF THE INCIDENT: JULY 7, 2011

- Air Attack asked Bonneville Superintendent if light mist from high level water bucket drops from the light Helicopter 3HX (assigned to the fire) would help cool down the crew, Hamm, and the area
- Bonneville Superintendent said yes.

THE DAY OF THE INCIDENT: JULY 7, 2011

- 1554: Operations Chief A made an outgoing cell phone call to Palo Pinto County Sheriff's Office and requested permission to land Helicopter 3HX at the Palo Pinto County hospital helipad in Mineral Wells.

0:11

THE DAY OF THE INCIDENT: JULY 7, 2011

- Pilot of Helicopter 3HX informed Air Attack that his helicopter was not configured to transport a medical litter but could haul an ambulatory patient
- The pilot added that all he needed to do was to unhook the water bucket prior to passenger transport.

THE DAY OF THE INCIDENT: JULY 7, 2011

- 1556: Crew EMT#2 arrived on scene. EMTs initiated cervical spine stabilization (C-Spine) due to the unknown cause of accident
- Both Crew EMTs moved Hamm to a flat rock nearby
- More sternum rubs were done
- Hamm was still responsive to pain stimulus
- Pulse was taken at brachial and carotid arteries.

0:11

THE DAY OF THE INCIDENT: JULY 7, 2011

- The radio traffic stated that the patient had a pulse of 120, respiration rate of 12, and pupils dilated but not fixed
- The patient was responding to pain, and had blue lips
- Hamm was very hot to the touch
- Crew EMTs attempted external cooling by removing Hamm's pack, shirt and boots and pouring water on him.

THE DAY OF THE INCIDENT: JULY 7, 2011

- 1556: Oxygen, backboard, and trauma kit arrived, and Hamm was placed on the backboard
- A tarp was held over him for shade while the IHC cut an extraction line from the FF's location to the nearest dirt road (about 300 feet)
- 1610: Hamm's condition deteriorated…
- Crew EMT#1 established airway by repositioning Hamm's head.

0:25

THE DAY OF THE INCIDENT: JULY 7, 2011

- 1610: Hamm stopped breathing
- Crew EMT#1 inserted an airway (oral pharyngeal airway)
- Crew EMTs gave Hamm several breaths using a CPR pocket mask
- Crewmembers were holding a tarp over Hamm for shade.

0:25

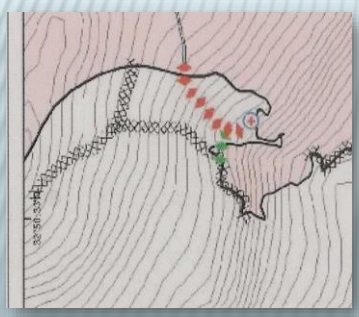
THE DAY OF THE INCIDENT: JULY 7, 2011

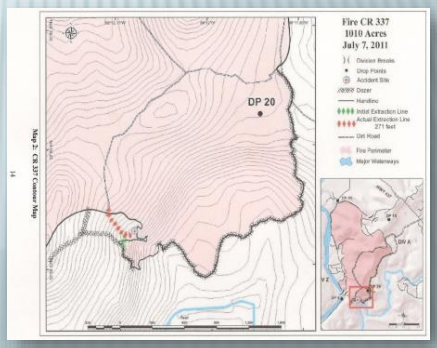
- Helicopter 3HX initiated high-level water-bucket drops to mist the crew
- The pilot did multiple bucket drops
- 1620: While the extraction line was being cut, Hamm went into cardiac arrest and CPR was initiated.

0:35

THE DAY OF THE INCIDENT: JULY 7, 2011

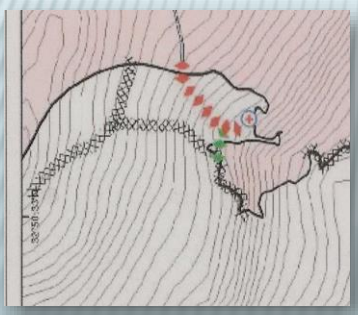
- The Bonneville IHC attempted to cut a direct path to the dozer line to be used to extract Hamm, which is labeled on maps in this report as “initial extraction line” (in green).

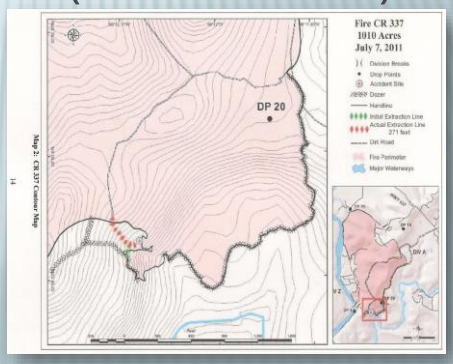




THE DAY OF THE INCIDENT: JULY 7, 2011

- A better route was established to the dirt road with the assistance of the Big Bear IHC, and that route is labeled on maps in this report as the “actual extraction line”(in red – 271 feet) .





THE DAY OF THE INCIDENT: JULY 7, 2011

- After several minutes of CPR at the accident site, Hamm was moved up the extraction line toward a truck by conveyor belt method up to the road
- CPR could not be performed during the extraction while Hamm was being moved to the truck, which took two to three minutes
- 1630: Firefighters loaded and secured Hamm onto the truck with Bonneville Crew EMT#1 and Crew EMT#2, who immediately resumed CPR.

0:40

THE DAY OF THE INCIDENT: JULY 7, 2011

- 1630: Helicopter 3HX guided Air Evac helicopter to DP 20 landing spot and dropped the last bucket of water for dust abatement (four total buckets were dropped on DP 20)
- Helicopter 3HX cleared the air space.

0:40

THE DAY OF THE INCIDENT: JULY 7, 2011

- 1633: Air Evac helicopter arrived at DP 20 with a medical flight crew (a paramedic and a Registered Nurse)
- 1635: Safety C transported medical flight crew in his truck, and drove uphill to meet the truck carrying Hamm.

0:45

THE DAY OF THE INCIDENT: JULY 7, 2011

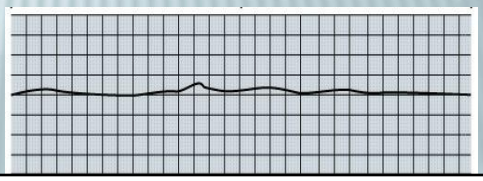
- 1635: Safety C with medical flight crew met the truck on the dirt road
- Medical flight crew joined Crew EMT#1, Crew EMT#2, and Hamm and began advanced patient care, as the truck continued down the dirt road toward the Medevac at DP 20.

0:45

THE DAY OF THE INCIDENT: JULY 7, 2011

- Mineral Wells Fire Department Ambulance headed up dirt road and met the truck coming downhill
- One of the ambulance's medical crew personnel got in the TFS Regional Fire Coordinator's truck
- On arrival at DP 20, the medic crews delivered oxygen to the FF by bag valve mask
- At 1637 hours the FF was intubated and had a pulse oximeter reading of 98% SaO2
- A cardiac monitor showed asystole (no heart beat).

0:47



THE DAY OF THE INCIDENT: JULY 7, 2011

- An intravenous (IV) line was started and ALS medications, including IV fluid, were administered
- 1637: The patient was in full cardiac arrest and the policy of the professional medical providers on scene is to transport patients without a pulse via ambulance as they can provide better patient care than what is possible in the helicopter.

0:47

THE DAY OF THE INCIDENT: JULY 7, 2011

- Hamm was transferred into the ambulance, where medical personnel continued advanced patient care. Crew EMT#1 and Crew EMT#2 continued CPR
- A cardiac monitor continued to show asystole (no heart beat)
- *Twelve minutes later*, at 1645, the ambulance departed DP 20 enroute to the nearest hospital
- *Palo Pinto General Hospital was seven miles from DP 20* (a 13 minute drive).

1:00

THE DAY OF THE INCIDENT: JULY 7, 2011

- While enroute the FF's heart rhythm changed to ventricular fibrillation and a shock (defibrillation) was administered on two separate occasions
- Both times the FF's heart rhythm reverted to asystole
- 1658: The ambulance arrived at Palo Pinto General Hospital in Mineral Wells, Texas .

1:13

THE DAY OF THE INCIDENT: JULY 7, 2011

- 1703: After working on the patient for five minutes, the hospital attending physician pronounced Caleb Hamm deceased
- Total time from incident onset to time of pronouncement is one hour and eighteen minutes (1545-1703)
- What happened here?.

1:18

THE DEATH OF CALEB HAMM

- Coroner's report listed cause of death as hyperthermia:
- *The FF had heatstroke*
- The FF had a core body (rectal) temperature of 108°F approximately 70 minutes after his collapse
- *His core body temperature probably was higher than 108°F at the time of his collapse.*

1:18

THE *"WHAT!?!"* QUESTIONS

- Caleb Hamm came from Boise, Idaho:
  - *The average temperature in the hottest month (July) is 74 °F*
- Prior to the incident, Caleb's Hotshot Crew had 3 days of travel
- Of the next five days, three were on standby; one was a cancelled assignment, and one was an evening shift
- The crew rested in hotels each night while on assignment in Texas
- *He probably lost some acclimatization benefits.*

THE *"WHAT!?!"* QUESTIONS

- Eleven minutes after his collapse, the patient's pulse was taken at "*brachial and carotid arteries*"
- As we learn in triage:
- *When you loose the radial pulse the blood pressure is below 80 mmHg systolic and the patient is critical:*
  - *Pedal pulse = 90 systolic*
  - *Radial pulse = 80 systolic*
  - *Femoral/Brachial pulse= 70 systolic*
  - *Carotid pulse = 50-60 systolic.*

THE *"WHAT!?!"* QUESTIONS

- Although the crew EMT suspected heat injury, *he was unsure of the exact cause of Hamm's unconsciousness…(?)*
- Crew EMTs attempted external cooling by removing Hamm's pack, shirt and boots and pouring water on him… *Eleven minutes after his collapse*
- However, they did C-spine stabilization and repeated sternal rubs *before cooling was attempted*
- Twenty-five minutes into the incident the EMT's placed Hamm on a backboard – *and he stopped breathing…*

What Will Kill My Patient FIRST?

THE *"WHAT!?!"* QUESTIONS

- The IHC attempted to "cut" a route to the dozer line, when someone decided to just take the patient out to the road – *how much time was wasted?*
- It took one hour for them to get Hamm into an ambulance – *by then he had been in full cardiac arrest for thirty minutes…*
- *And yet they did not depart for an additional twelve minutes.*

THE *"WHAT!?!"* QUESTIONS

- Although they moved him by a truck – he was not put in the air-conditioned cab
- Approximately 15 minutes after his cardiac arrest the FF arrived at the drop point and the local ambulance and Air Evacuation units initiated advanced life support (ALS) *but their treatment protocols for exertional heatstroke did not include cold/ice water immersion therapy…*

BLS Saves Lives… *NOT ALS…*

And Our Body's Temperature Regulation

HEAT EMERGENCIES

HEAT RELATED ILLNESS

- The body *gains* heat by:
  - Conduction
  - Convection
  - Radiation
  - Exercise…
- Past a certain point, we have problems…

HEAT RELATED ILLNESS

- Heatstroke, the most severe form of HRI, is a life-threatening condition;
  - It is defined as a core body temperature greater than 104°F with central nervous system disturbances (ALOC) and multiple organ system failure
- In the general population, heatstroke has a mortality rate ranging from 33%-80%
- However, when immediate cold/ice water immersion is administered for exertional heatstroke, studies suggest a dramatic reduction in mortality .

HEAT RELATED ILLNESS

- Heatstroke is relatively rare in wildland firefighting
- Among wildland fire fighters and structural fire fighters assigned to wildland/grass/brush fires, the National Fire Protection Association (NFPA) reported seven heatstroke deaths for the 33-year period from 1979 to 2011 .

HEAT RELATED ILLNESS

- *However…*
- During the NIOSH interviews at the CR 337 fire, many IHC members reported symptoms consistent with mild to moderate HRI, not only at this incident, but throughout their careers
- These symptoms included feeling hot, exhausted, and nauseated, and having headaches
- *None, however, reported a heat-related injury/illness to their supervisors or into a reporting system.*

HEAT RELATED ILLNESS

- When asked why they had not reported the incident, crewmembers responded that they considered it "part of the job" and feared a negative influence on being rehired the next fire season
- A 1996 survey of over 1,000 wildland fire fighters found that many fire fighters "do not report safety-related incidents":

  1) out of fear of discipline or reprisal,

  2) because the reporting system is inconvenient,

  3) because they believe that the report will not be acted upon, or

  4) they fear losing hard earned credibility.

HRI: RISK FACTORS

- Personal risk factors for exertional heatstroke include:
  - increased age,
  - poor physical fitness,
  - a previous history of exertional heatstroke,
  - various medical conditions (e.g., heart disease, renal disease, diabetes mellitus, skin conditions, sunburn, sweat gland dysfunction, viral illness, diarrhea, etc.)…

HRI: RISK FACTORS

- Personal risk factors for exertional heatstroke include:
  - some medications (e.g., drugs that reduce sweating such as antihistamines (e.g., Benadryl®),
  - drugs that reduce cutaneous blood flow (e.g., stimulants such as cocaine, amphetamines, ephedrine, pseudoephedrine, caffeine, energy drinks, dietary supplements, theophylline),
  - drugs that can cause dehydration (e.g., diuretics),
  - and drugs that can inhibit central thermoregulation (e.g., neuroleptics and tricyclic antidepressants)…

HRI: RISK FACTORS

- Additional risk factors for HRI and heatstroke include:
- dehydration,
- lack of heat acclimatization,
- sleep deprivation,
- and fatigue.

RISK FACTORS: DEHYDRATION

- Dehydration occurs during prolonged exertion when fluid losses from sweating and rapid breathing are greater than fluid intake
- The reduced intravascular volume associated with dehydration results in reduced blood flow to the skin (convection heat loss) and reduced sweating (evaporative heat loss), two of the body's most important cooling mechanisms
- *Caleb Hamm was not dehydrated.*

RISK FACTORS: ACCLIMATIZATION

- Lack of heat acclimatization is another heatstroke risk factor:
- With heat acclimatization, physiological changes (sweating at a lower temperature, more sweating, less electrolyte loss, etc.) make the body more efficient in dealing with heat stress
- To fully acclimatize, however, the body needs to experience the actual work conditions in consecutively increasing 1½- to 2-hour increments.

RISK FACTORS: ACCLIMATIZATION

- Adaptive physiological changes occur within 4 days, but complete acclimatization can take up to 3 weeks
- Once heat stress exposure stops, the body's adaptive mechanisms regress; *clinically significant reductions are seen within 4 days*
- With 1 to 2 weeks without exposure, re-acclimatization requires 4 to 7 days
- However, with 3 days of travel and 3 days of staging between June 29 and July 4, Hamm probably lost some acclimatization benefits.

SIGNS OF HEAT STRAIN

- An individual's heat stress exposure should be discontinued when any of the following signs of heat strain occur:
  - Sustained (over several minutes) heart rate in excess of 180 beats per minute (bpm) minus the individual's age in years;
  - Core body temperature above 38 °C (100.4 °F) in unacclimatized personnel and above 38.5 °C (101.3 °F) in heat-acclimatized personnel;
  - Recovery heart rate above 100 bpm at 1 minute after peak work effort;
  - Symptoms of sudden and severe fatigue, nausea, dizziness, or lightheadedness.

HEATSTROKE TREATMENT

- Rapid core body temperature reduction is the most important treatment for exertional heatstroke
- Cold/ice water immersion seems to be the best method
- In the CR 337 incident, it was impractical for the Agency to provide ice along the fire line (e.g., at DP 20).

HEATSTROKE TREATMENT

- Ice packs at the large arteries near the skin surface:
  - Neck/carotids
  - Armpit/brachials
  - Groin/femorals
- Ice packs applied this way can cool a human body almost 1 degree per minute, and can continue to cool for over 25 minutes
- Chemical cold packs will cool a human body only about 0.2 degrees per minute, and will only last for five minutes before being replaced.

HEATSTROKE TREATMENT

Chemical Cold Packs for Treating Hyperthermia

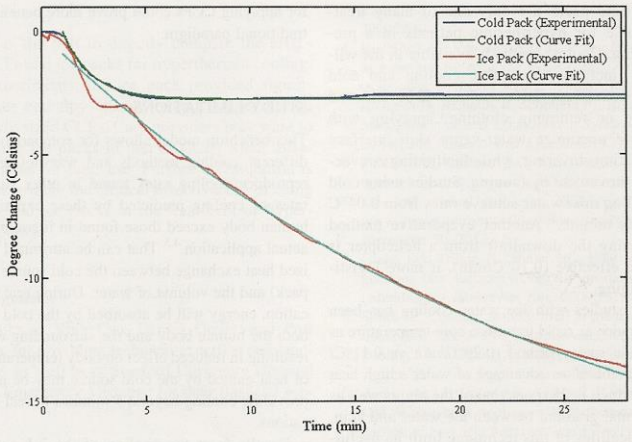


Figure 2. Comparison of ice pack versus chemical cold pack treatment.

HEATSTROKE TREATMENT

- Cutaneous blood flow in the normal-temperature human averages 200 to 250 mL/min
- Heat stress causes vasodilation that can increase this amount to 7000 mL/min
- A new thought to the treatment of hyperthermia takes advantage of this increase in blood flow in the hands:
- Virtually all mammals have hairless areas of the body that contain networks of veins called AVAs (arteriovenous anastomoses), which help with quickly managing body temperatures
  - Bears, for instance, have them on the pads of their paws and their nose, and these small patches of skin appear to be nearly solely responsible for keeping bears from overheating in the summer.

HEATSTROKE TREATMENT

- When just the right amount of cooling, neither too much nor too little, is applied, it has drastic effects on altering core body temperatures quickly
- On humans, there are AVAs on the palms of the hands
- Consider using a chemical cold pack in a container of water and hold it in your hands.

HEATSTROKE TREATMENT

- BUT the best case-scenario would be to not allow your patient to go into a life-threatening hyperthermia in the first place
- *We need to treat this condition before it becomes a life threat*
- *NIOSH Recommendations…*

NIOSH RECOMMENDATIONS

- Recommendation #1:
- Strengthen the agency's heat stress program with the following components:

  A. Instruct fire fighters and command staff that hydration *alone* will not prevent HRI

  - Although they can occur together, only 20% of hospitalized heatstroke cases show signs of dehydration.

NIOSH RECOMMENDATIONS

- Recommendation #1:
- Strengthen the agency's heat stress program with the following components:

  B. Develop re-acclimatization schedules for wildland fire fighters not working for more than 4 days;

  - For example, 6 days with no heat exposure would require 3 days of re-acclimatization.

NIOSH RECOMMENDATIONS

- Recommendation #2:
- Always work in pairs and/or be in direct communication with crewmembers
- Recommendation #3:
- Promptly alert local EMS units of a medical emergency per Incident Command protocols
- Recommendation #4:
- When exertional heatstroke is suspected, inform responding EMS units of the potential need for cold/ice water immersion therapy.

NIOSH RECOMMENDATIONS

- Recommendation #5:
- Seek input from crewmembers and frontline supervisors about removing barriers, real or perceived, to reporting or seeking medical attention for heat strain or HRI
- Recommendation #6:
- Consider cases of HRI, particularly severe cases such as heatstroke or rhabdomyolysis that result in death or hospitalization, as a sign that the current heat stress program is inadequate.

RECOMMENDATIONS- *FOR US*

- The signs and symptoms of heatstroke are subtle
- It must be recognized and treated BEFORE it is too late:
  - The best person to recognize HRI is *who?*

DEHYDRATION

- Dehydration can exacerbate any HRI:
  - Water leaves the body at an alarming rate
  - Normal loss 2-3 liters / day
  - Strenuous exercise – 1-2 liters / ***hour.***

Being dehydrated can exasperate all of these problems -

DEHYDRATION

- Loss of only 1.5 liters (*one hour of work*):
  - Endurance reduced by 22 %
  - Maximum oxygen intake lowered by 10 %.

DEHYDRATION

- Loss of 3 to 4 liters (*two hours of work*):
  - Endurance reduced by *50 %*
  - Maximum oxygen intake lowered by *25 %.*

DEHYDRATION S&S

- Mild: (2% body weight loss)
  - Dry mucous membranes, normal pulse, darkened urine, thirst, headache
- Moderate: (5% body weight loss)
  - Very dry mucous membranes, rapid weak pulse, dark urine, thirst, disorientation
- Severe: (>8% body weight loss)
  - ALOC, no urine, no sweat, shock (rapid weak pulse, rapid breathing, pale skin)
- Fatal (22-30% body weight loss)
  - Coma leading to death.

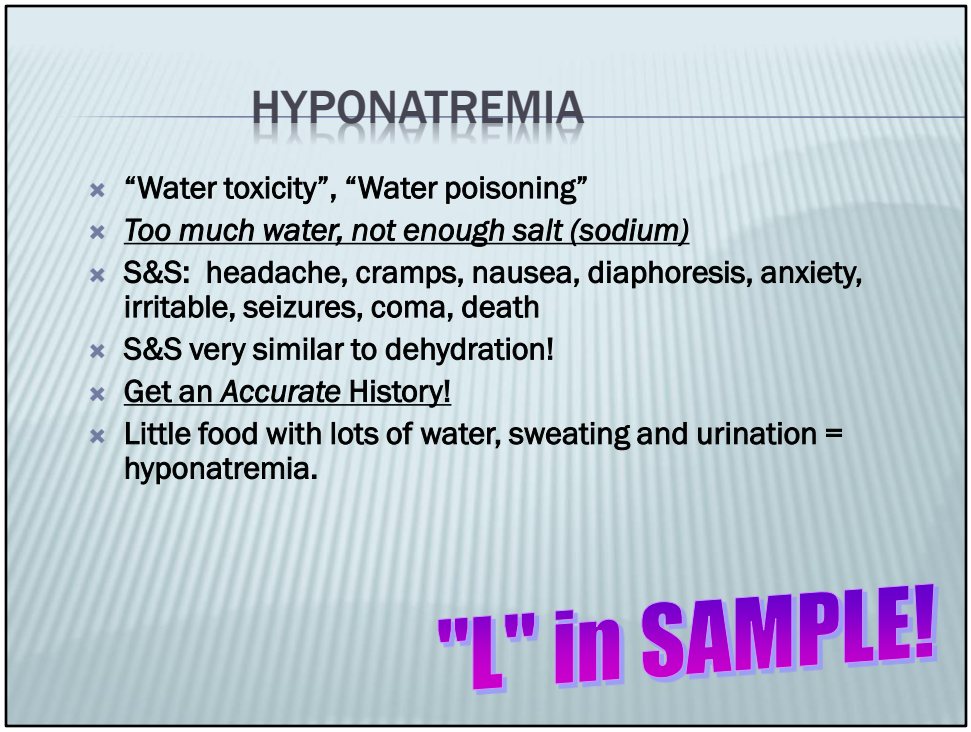
Remember what we said earlier – for each one percent of weight loss due to dehydration your body will produce almost one-half a degree more heat. With these figures above – your patient is in trouble after only 5% loss

DEHYDRATION

- Treatment:
  - For mild to moderate: 200-250 mls of replacement fluids (not just water) per 30 minutes for the first 4-6 hours
- Prevention:
  - *Don't become dehydrated in the first place*
  - According to the WMS: you need 300-500 mls water per hour, higher with extreme exertions
  - Best consumed 200 mls at a time
  - With this is salty snacks (not just carbs)
  - Or commercial sports drinks:
    - 6% glucose and 10-25 mEq /Liter sodium.

DEHYDRATION TREATMENT

- Best treatment is <u>prevention:</u>
- Take it this way…
- *Or you'll take it this way..*



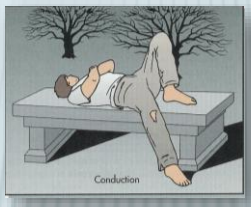
Too much of a good thing – yes, you can have too much water.

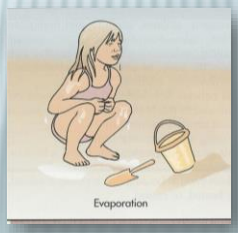
COLD EMERGENCIES

While our body cannot be heated too much, it cannot be cooled either. More emphasis has been focused on hypothermia lately – because of trauma, and we will take a look at what it means for our patients.

THE ROLE OF THE ENVIRONMENT

- The body *looses* heat by:
  - Conduction
  - Convection
  - Evaporation
  - Radiation
  - Respiration.





Remember the word “homeostasis”? The environment is trying to get our body to reach its temperature, and our body is trying to stay within the normal range of 95 – 101 degrees F. Once we get outside that range, we have problems.

COLD-RELATED EMERGENCIES

- Two types:
  - Hypothermia: generalized condition
  - Frostbite: localized condition…

GENERALIZED HYPOTHERMIA

- Accidental hypothermia is one of the most commonly encountered emergencies in the wilderness, *not only in the winter but in any season and in almost any location*
- We must be aware of this happening in all our patients:
  - Especially in SAR events
  - Especially in trauma
  - Especially for pediatrics
  - Especially for geriatrics.

Perhaps you've heard the saying "cotton kills"? This is why – cotton clothing can hold moisture next to the skin – causing fast and deadly hypothermia. Wool is best for winter wear – it wicks moisture out away from the skin.

GENERALIZED HYPOTHERMIA

- More likely to occur between 40-50° F
- More cases seen in spring/fall than in winter
- Moist air, windy conditions and wet clothing increase the chance
- Hunters, fishermen, hikers and recreational bikers are prone to hypothermia
  - Especially if they are "stuck"
  - Very common with trauma patients
  - Very, very common if dehydrated
- Defined as a core body temp < 95° F.

DEGREES OF HYPOTHERMIA

- Mild hypothermia (96.8°F down to 93.2°F);
  - The "umbles" (mumble, fumble, stumble)
  - Lack of sound judgment, confusion
  - Agitation and a "flat" affect
  - Cold diuresis.

Cold-induced diuresis, or cold diuresis, is a phenomenon that occurs in humans after exposure to a hypothermic environment, usually during mild to moderate hypothermia.[14] It is currently thought to be caused by the redirection of blood from the extremities to the core due to peripheral vasoconstriction, which increases the fluid volume in the core. Overall, acute exposure to cold is thought to induce a diuretic response due to an increase mean arterial pressure.[15] The arterial cells of the kidneys sense the increase in blood pressure and signal the kidneys to excrete superfluous fluid in an attempt to stabilize the pressure. The kidneys increase urine production and fill the bladder; when the bladder fills, the individual may then feel the urge to urinate. This phenomenon usually occurs after mental function has decreased to a level significantly below normal. Cold diuresis has been observed in cases of accidental hypothermia as well as a side effect of therapeutic hypothermia, specifically during the induction phase

DEGREES OF HYPOTHERMIA

- Moderate hypothermia (91.4°F down to 86°F)
  - Uncontrollable shivering
  - Increased confusion
  - Lethargy, hallucinations and ataxia.

So now we've gone from the umbles to ataxia (no control) the brain is being affected, uncontrollable shivering. The shivering is the body's attempt to produce heat by muscle movement. This can cause the metabolism to use up the available glucose 6 times normal. These people will be hypoglycemic.

DEGREES OF HYPOTHERMIA

- Severe hypothermia (< 86°F);
  - Cessation of shivering
  - Hypoventilation, bradycardia, hypotension
  - Muscle rigidity
  - Nausea and vomiting
  - Coma, may appear to be dead.

The body just gives up here – shivering stops. The heart rate slows so much that you need to do a pulse check for about one minute before starting chest compressions. Do not do CPR if you have a pulse – it may throw them into V fib.

DEGREES OF HYPOTHERMIA

- Hypothermia represents a progression of deterioration
- How can we tell the degree of hypothermia in the field?:
  - Mild = (above 86° F core temp) patient *can* obey commands
  - Severe = (86-82° F core temp) patient *can't* obey your commands, *but you can detect pulse*
  - Unstable = (<82° F core temp) patient has no detectible pulses may be in cardiac arrest.

40 DEGREES OF HYPOTHERMIA

- 99° = normal
- 97° = shivering begins
- 95° = heat is produced – *basal metabolism 6X normal*
- 93° = stumble
- 91° = shivering slows
- 90° = memory loss occurs
- 86° = no control by brain higher functions
- 81° = coma
- 77° = blood pressure starts to fall
- 75° = breathing slows
- 68° = EEG flat
- 59° = heart stops.

OK not quite 40 of them

TREATMENT OF HYPOTHERMIA

- GET YOUR PATIENT AS WARM AS POSSIBLE, AS FAST AS POSSIBLE
- But WATCH for signs of shock
- Rewarming shock: or “after drop”
- This can be fatal – this is why they die later.

TREATMENT OF HYPOTHERMIA

- "Afterdrop":
  - The patient's core temperature drops further after warming and removal from the cold
  - Venous return of cool peripheral blood to a warmer body core
  - Acid and potassium gets dumped into the heart/brain/liver and the organs are poisoned
  - Body is unable to process the waste products from an increased metabolism.

TREATMENT OF HYPOTHERMIA

- "Afterdrop":
  - Can cause serious dysrhythmias/shock
  - Exercise may also cause this – only allow exercise in the moderate hypothermia patient after 45 to 60 minutes of shivering in an insulated environment
- Always watch your patient for signs of shock.

TREATMENT OF HYPOTHERMIA

- Passive rewarming: good for the milder forms of hypothermia (but they need core heat to rewarm)
  - Remove from the cold environment, protect from wind
  - Replace damp clothing with dry – do not rub
  - Add insulation and/or warm packs, keep horizontal, get off the ground and into shelter
  - Hot water bottles / warm packs at hands, chest, neck, groin
  - Warm, sweet fluids to drink – *IF they can swallow without compromising airway*
  - No exercise.

Warm sweet fluids, but NOT caffeine or alcohol

TREATMENT OF HYPOTHERMIA

- Cardiac arrest can occur when the severely hypothermic patient is moved, unclothed or an advanced airway is placed:
  - May have to do CPR for over 4 hours
  - 99.9% unsuccessful in the field
  - *Danger to the rescuers*
- They are dead when YOU say they are dead.

They are dead when you say so – not when they are "warm"

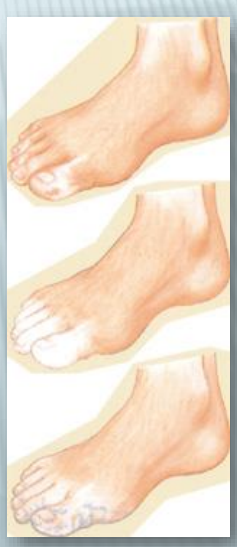
TREATMENT OF HYPOTHERMIA

- Long pulse check before CPR (one full minute):
- Be certain there is a total lack of palpable pulses
  - Chest compressions can cause dysrhythmia
- Defibrillation is rarely effective below a body temperature of about 90°F
- BLS should be continued until at least partial rewarming.

We will take a further look at the problems with hypothermia and the trauma patient – especially during a loss of blood. Hypothermia has become something we should ALWAYS think about in the field!

LOCALIZED COLD EMERGENCY

- *Frostbite: Localized* freezing of tissue
- Common on extremities; ears, nose,
  - Below 24°F
  - High winds, high altitude, in contact metal, water or gasoline
  - With overexertion or using alcohol, tobacco or caffeine
- Progressing from mild to severe:
  - Superficial
  - Full-thickness.



SUPERFICIAL FROSTBITE

- "Frostnip":
- Fingers/toes are numb, cold, any color
- Outer layer of skin may have been frozen
- Warm by contact with warm skin – no special treatment is needed, but…
- Severe pain on rewarming!
- *But: do not massage, place near a strong radiant heat source or allow to re-freeze.*

SUPERFICIAL FROSTBITE

- Bleb formation
- Try not to break the blisters

- Prevent re-freezing
- Wrap with dry, sterile dressings…
- Evacuate.

FULL-THICKNESS FROSTBITE

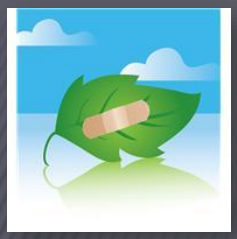
- Deep tissue is frozen solid
- Icy cold and completely numb
- Frozen part is dead – will have to be amputated
- Extremely painful
- Protect from environment
- Evacuate immediately.

NON FREEZING COLD INJURY

- Seen in WWI
- Immersion foot or trench foot
- Prolonged contact with cold/moisture
- With inadequate circulation
- Feet are swollen, dark burgundy to purple/blue splotches.

NON FREEZING COLD INJURY

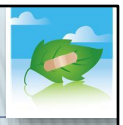
- Later stages skin becomes red, hot with blisters
- Infection and gangrene frequently result
- Remove wet shoes, socks - dry
- Re-warm gradually
- Transport for evaluation.



Section Six

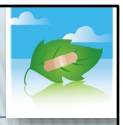
WILDERNESS WOUND MANAGEMENT

WOUND CARE



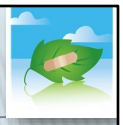
- The most common medical problem
- However, “out there” even trivial wounds can develop an infection
- Contusions, abrasions, lacerations, avulsions, amputations, punctures, impaled objects, bite wounds, fractures, burns…and blisters.

WOUND CARE



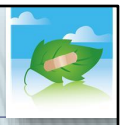
- A healthy immune system can protect living tissue in minor wounds if the wound is not too dirty
- Foreign matter becomes colonization sites for bacteria
- The only way to prevent infection in the wilderness setting is to clean the wound.

WILDERNESS WOUND MANAGEMENT



- All wounds acquired in a wilderness environment should be regarded as contaminated and will require cleansing to prevent infection and promote healing
- Three effective methods available:
  - Scrubbing
  - Irrigating
  - Debriding.

WILDERNESS WOUND MANAGEMENT

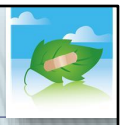


- Scrubbing:
- Disinfectants (isopropyl alcohol, povodine/iodine, hydrogen peroxide), soaps and detergents should generally NOT be applied directly into the wound
- These can damage living tissue and may actually increase the incident of tissue death and scaring.

WOUND CARE

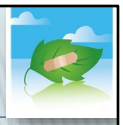
- Scrub *around* the wound
  - All unprocessed honey seems to reduce wound infection and promote healing – the sugar dehydrates bacteria, keeps the wound moist and serves as a physical barrier
  - Antibiotic ointments do not actually kill bacteria, they keep the wound moist and provide a barrier.

WILDERNESS WOUND MANAGEMENT



- Irrigating:
  - The most effective and practical method of removing bacteria and debris from a wound involves using a high-pressure irrigation syringe
  - Improvise by using a plastic bag full of water with a pin-hole in one corner, squeeze forcefully
  - Use the cleanest water available
  - 1-2 inches from the surface of the wound, at an angle to get the contaminants out and away
  - Use at least 500 mls (more for larger or heavily contaminated wounds).

WILDERNESS WOUND MANAGEMENT



- Debriding:
  - Deeply imbedded, visible debris not removed by irrigation may be removed carefully with forceps (sterilized in boiling water or by open flame)
- Any renewed bleeding can be controlled by direct pressure
- It is important to remove as much foreign material as you possible can.

WOUND CARE

- Gloves and eye protection are required.

IMPROVISE: Cover the wound with your gloved hand as you irrigate

WOUND CARE

- Any wound large enough for evacuation should be left open / covered only
- Small, well cleaned wounds can be closed with tape

IMPROVISE: cut a band-aid into strips

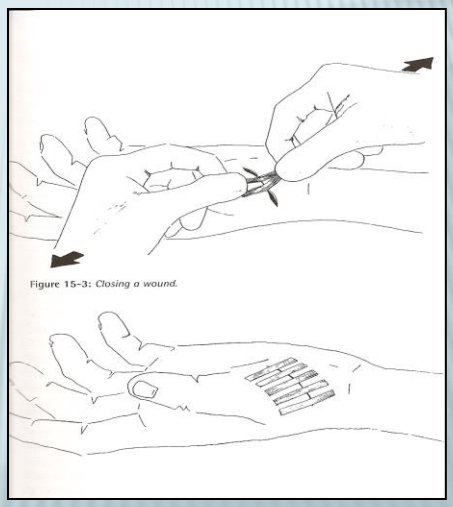


Figure 15–3: *Closing a wound.*

Close small wounds with tape strips or a band-aid by pulling on opposite sides.

WOUND CARE

- The dressing can be coated with antibiotic ointments or use occlusive microthin film dressings
- If conditions and materials allow, change the dressings every 12 hours - over the long term evacuation

Close small wounds with tape strips or a band-aid by pulling on opposite sides.

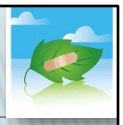
WOUND CARE

- After closing/dressing a deep or large wound on an extremity consider splinting and elevation to reduce lymphatic flow.

IMPROVISE: Don't have a splint? What can you use instead?

What other materials can be used to immobilize a limb? The possibilities are endless!

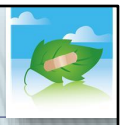
WOUND CARE- GLUE



- Dermabond is packaged in a small single-use applicator and costs about $30 per tube
- Paint the tissue glue over the exposed wound edges using a very light brushing motion of the applicator tip on the skin
- Avoid excess pressure of the applicator on the tissue because this could separate the skin edges, forcing glue into the wound
- Apply multiple thin layers (at least three), allowing the glue to dry between each application (about 2 minutes).

What other materials can be used to immobilize a limb? The possibilities are endless!

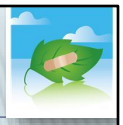
WOUND CARE- GLUE



- Do not apply it directly into an open wound
- For a large wound, use closure strips first to close the wound edges, remove one at a time and apply glue
- Do not use petroleum-based ointments – these will weaken the glue and it will fall off
- After gluing – re-apply closure strips.

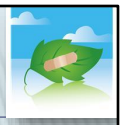
What other materials can be used to immobilize a limb? The possibilities are endless!

BANDAGING



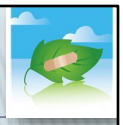
- Sterile is best…
- Clean is second best…
- Anything you've got is better than nothing
- Remember to have lots of Band-Aids, gloves and triangular bandages on your engines/ backpack
- Always monitor for infection.

BANDAGING



- Dressing goes directly on the wound
  - The best initial dressing is one that won't stick to the wound
  - An antibiotic ointment or honey can be used on the wound surface
- A slightly moist environment is preferable to a dry one (unless it is a burn)
- Then place a dry dressing on top of the moist one
- Bandage to hold in place (not too tight).

BANDAGING



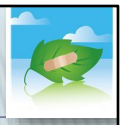
- Check the wound daily for signs of infection
- There is a 5% chance of becoming infected, even if it was properly cleaned
- If signs develop, remove the bandaging and open the wound to allow for drainage
- Pack the wound open with moist gauze daily and evacuate immediately.

WOUND CARE

- S & S of infection include: increasing redness (streaks up lymph tract), heat and swelling, pus production (white, yellow, green, brown), pain increases, mobility decreases
- Lymph nodes can become large and painful (elbows, knees, neck, armpits and groin).

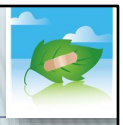
Darkening pus shows a possibility of gangrenous wound.

WOUND CARE



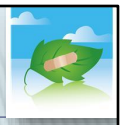
- Should the infection reach the bloodstream, septicemia and septic shock will (eventually) result:
  - Fever / chills
  - Malaise
  - Headache
  - Nausea / vomiting
- *This is a Life-threatening condition*.

EVACUATION GUIDELINES



- Wounds should be covered with a sterile, breathable dressing to keep additional dirt out of the repair
- *Most* lacerations can be dealt with in the backcountry and do not require evacuation
- *However….*

EVACUATION GUIDELINES



- Any deep and/or contaminated wound requires immediate evacuation to definitive care:
  - Wounds that reveal underlying structures (ligaments/tendons)
  - Wounds caused by a crushing mechanism
  - Deep puncture wounds that cannot be cleaned in the wilderness
- Wounds on the face or hands require special attention, suturing and continued care.

ANAPHYLAXIS

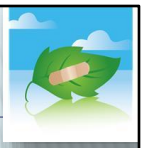
WILDERNESS ISSUE – MULTIPLE DOSE

What if the patient needs more than just one dose of epinephrine.....
But has only one Epi Pen?

https://www.youtube.com/watch?v=luultUD0eK0&ab_channel=Dr.JulieBrown

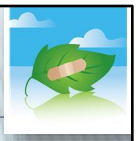
YouTube Video – getting more doses out of an epi pen:
https://www.youtube.com/watch?v=luultUD0eK0&ab_channel=Dr.JulieBrown

WILDERNESS



- If you begin to have any skin signs in your patient -
- AND any airway involvement in your patient –
  - Difficulty breathing
  - Wheezing sounds
- Benadryl works differently – there is only one treatment for anaphylaxis; epinephrine
- And they have an Epi Pen – *it must be injected to save the patient's life.*

WILDERNESS



- An auto-injector should not substitute for immediate medical care; patients should be advised to seek medical treatment following any use of an auto-injector
- Side effects of epinephrine include increased heart rate and blood pressure, palpitations, sweating, and headache.

Practice with the epipens

WATER
EMERGENCIES

WATER-RELATED EMERGENCIES

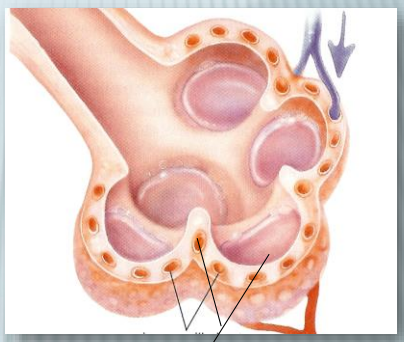
- Terms: “near drowning,” “dry drowning,” “wet drowning,” “secondary drowning” and “passive drowning” *have been abandoned*
- Accepted terms: “drowning”.

WATER-RELATED EMERGENCIES

- Drowning is the process of experiencing respiratory impairment from submersion/immersion in a liquid medium, thus preventing the victim from breathing air
  - Immersion means to be covered in water. Usually at least the face and airway are immersed for drowning to occur
  - Submersion means the entire body, including the airway, is under water.

WATER-RELATED EMERGENCIES

- At the most fundamental level, fatal drowning is death from asphyxia.



WATER-RELATED EMERGENCIES

- The drowning process begins when the patient's airway is below the water:
  - Initially, there's breath holding
  - Small amount of water (< 30 mL) may enter the lungs
  - Early part of unconsciousness: reflex swallowing
  - Even if water enters the lungs during this period, it's typically only a small amount.

WATER-RELATED EMERGENCIES

- No such thing as a “dry drowning”
- The brainstem will stimulate involuntary breathing:
  - Unconsciousness within four to six minutes of submersion
- The water in the lungs washes away surfactant:
  - Collapse of the alveoli
  - Aspirated water is directly toxic to the cells of the alveoli
  - Bronchoconstriction, inflammation and hypoxic vasoconstriction.

WATER-RELATED EMERGENCIES

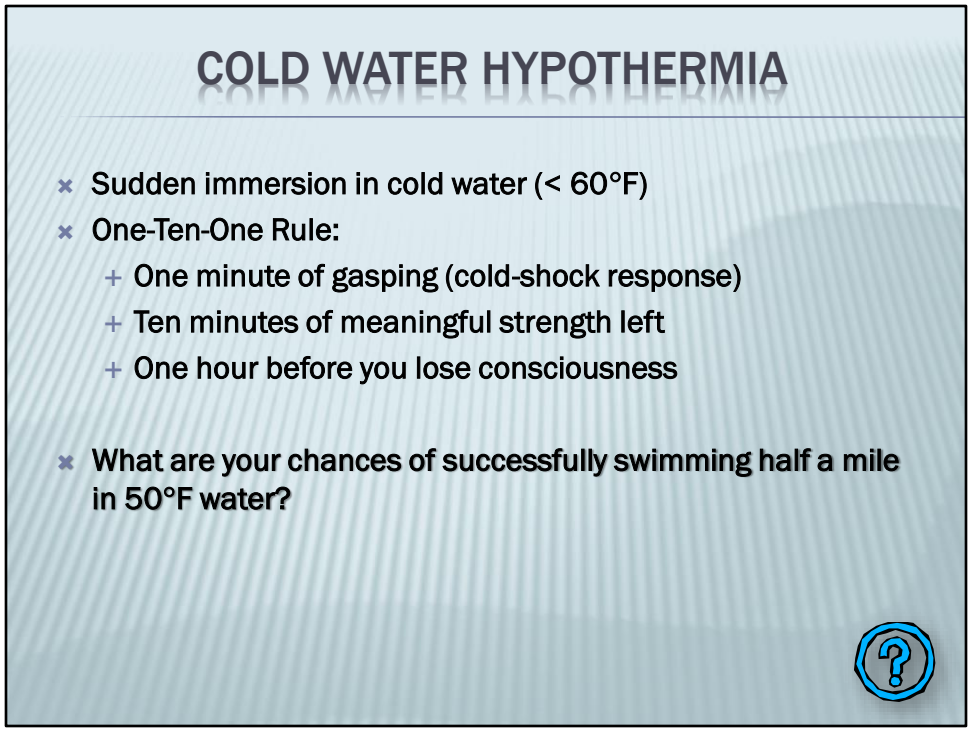
- All drowning patients are initially treated the same :
- The final common pathway of all illness and death is hypoxia with resultant anoxic brain injury
- Non-sterile water, salt or chlorine, the lungs typically recover
- Emergency treatment should be directed at interrupting the drowning process by providing oxygenation and ventilation as quickly as possible.

WATER-RELATED EMERGENCIES

- High risk for the rescuer:
  1. Teach
  2. Reach
  3. Throw
  4. Tow
  5. Row
  6. *Go.*

SPECIAL PRECAUTIONS

- Be alert for immersion hypothermia
- Be aware of spinal injuries from diving/whitewater accidents
- Resuscitation efforts focus on scene safety and ABC's
- Begin rescue breathing while still in water (if safe for rescuer)
- Post -drowning may still die later.



Mamalian Dive Response

Bradycardia, a slowing of the heart rate. The human heart rate slows down 10 – 30% and up to 50% or more in trained individuals.
Peripheral vasoconstriction (a narrowing of blood vessels to reduce blood flow by muscle contraction in the blood vessel's wall),causes reduced blood flow to the limbs ensuring that oxygen sensitive organs like the brain and heart receive oxygen.
During deep dives a **blood shift** occurs allowing blood plasma and water to pass through organs and circulatory walls to the chest cavity to protect the organs from the increase in pressure. The lungs gradually fill up with blood plasma, which is reabsorbed when pressure drops.

LIGHTNING INJURIES

LIGHTNING INJURIES

- Fatalities happen 50 times a year in the US:
  - High voltage
  - High amps
  - High temperature
- In less than 1/10th of a second
- Lightning electricity, as with all electrical energy, will travel the path of least resistance:
  - In body tissues, the order of least to greatest resistance is as follows: nerves, blood vessels, muscles, skin, fat, bone.

•According to the NOAA, over the last 20 years, the United States averaged 51 annual lightning strike fatalities, placing it in the second position, just behind floods for deadly weather.[8][9] In the US, between 9% and 10% of those struck die,[10] for an average of 40 to 50 deaths per year (28 in 2008).

PREVENTION OF LIGHTNING INJURIES

- Be aware of the current and predicted weather
- Avoid ridges, wide open spaces, standing water, cave entrances and shallow overhangs, lone trees (or the tallest tree in the immediate area).

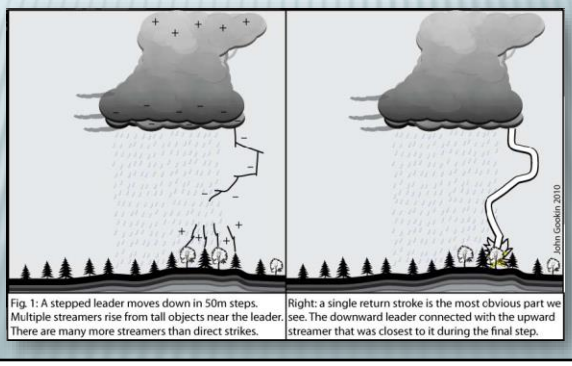


Fig. 1: A stepped leader moves down in 50m steps. Multiple streamers rise from tall objects near the leader. There are many more streamers than direct strikes.

Right: a single return stroke is the most obvious part we see. The downward leader connected with the upward streamer that was closest to it during the final step.

Lightning Injuries.

- Lightning injuries can occur from:
  - Direct strike,
  - Contact with a struck object
  - Splash off of another object,
  - Ground currents
  - Blunt trauma from the lightning shockwave.

LIGHTNING INJURIES

- Direct strike
- Contact
- Side flash
- Ground (step voltage).

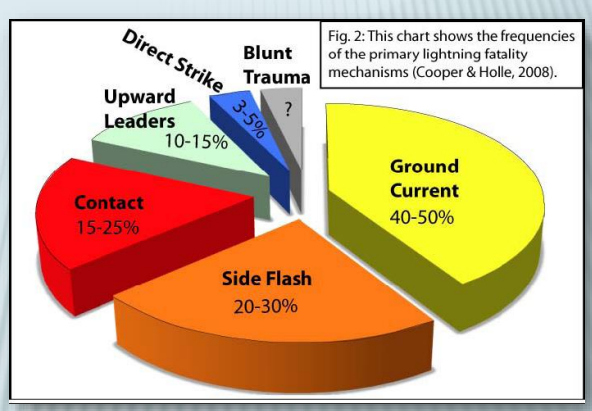
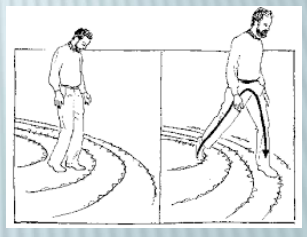


Fig. 2: This chart shows the frequencies of the primary lightning fatality mechanisms (Cooper & Holle, 2008).

- Strikes men 75 % of the time
  - People riding tractors
  - Open water
  - Golf courses
  - Under trees
- Side splash, or splash strikes don't have as much power

LIGHTING INJURIES

- **Step voltage: 40 to 50% injuries:**
- Shuffle your feet or do the "bunny hop".



Correct Incorrect!

- Strikes men 75 % of the time
  - People riding tractors
  - Open water
  - Golf courses
  - Under trees
- Side splash, or splash strikes don't have as much power

LIGHTING INJURIES

- Lightning hits the tallest object around –
  - Mountain tops
  - Trees
  - Tallest bush
  - Boat masts
  - Power lines
  - Metal fence posts
  - Animals
  - People.

23 cows along a fence in Idaho

- Strikes men 75 % of the time
  - People riding tractors
  - Open water
  - Golf courses
  - Under trees
- Side splash, or splash strikes don't have as much power

PREVENTION OF LIGHTNING INJURIES

- Spread groups out – at least 50 feet between individuals
- Sit (do not stand) on a pad or other non-conductive object
- Get rid of your tools
- Make yourself as small as possible – get the least potential difference between the separate points of your body.

LIGHTNING INJURIES

- Can cause cardiac arrest, respiratory arrest, neurological injuries, burns and blast injuries
- Signs & symptoms may not become apparent until hours / days after the injury
- A common cause of fatality in lightning injury is sudden cardiac death (SCD)
- Ocular injuries are common after lightning strike and include injured lens and cataracts
- Tympanic membrane (TM) rupture was present in more than 60% of subjects.

LIGHTNING INJURIES

Three MOI with lightning injuries:

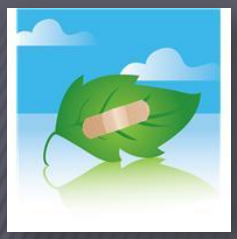
1. Electrical shock:
   - Neuro-electrical Damage:
     - Current through the torso or brain can stop the heart or stop breathing
     - Current through the tissues can also lead to numbness, paralysis, or other nervous system dysfunction
     - Lichtenberg figures.

Just remember the potential for large internal injuries.

ASSESSMENT OF LIGHTNING INJURIES

- Many times results in V-fib
  - So don't forget your AED
- Easily worked code that can be saved with aggressive treatment ("reverse triage" with MCI)
- The only danger that remains is that from the continuing storm…lightning DOES strike twice !
- All patients require a complete body survey and careful evaluation for head, spinal, long bone, or cardiac injuries.

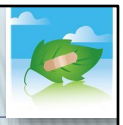
Just remember the potential for large internal injuries.



Section Seven

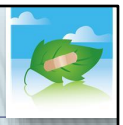
WILDERNESS IMPROVISATION

IMPROVISED EQUIPMENT



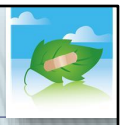
- At the heart of wilderness medicine is improvisation, a unique combination of medical science integrated with creativity and ingenuity
- In the wilderness, you must utilize whatever supplies or materials are on hand *and depend heavily on common sense*
- In this overview we will cover some thing that are not in TCEMSA protocols
- It is not inclusive – every emergency is unique.

IMPROVISED EQUIPMENT



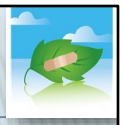
- ABC's:
- Opening the airway – if you do not have airway adjuncts
- Consider grabbing the tongue with rough cloth and pulling it forward to help keep the airway open
- A glove can be modified and used as a barrier shield for mouth-to-mouth:
- Cut the middle finger halfway, insert the glove in the patient's mouth and stretch across the face
  - The slit creates a one-way valve.

IMPROVISED EQUIPMENT



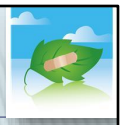
- Closing Head wounds:
- Scalps tend to bleed profusely
- Take a piece of dental floss and lay on top of and parallel to the wound
- Twirl a few stands of hair on opposite sides of the wound and pull them together tightly, forcing the wound edges closes
- Use the floss material to tie the opposing strands of hair together with a square knot.

IMPROVISED EQUIPMENT



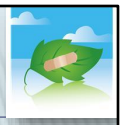
- Knee injuries:
- Sprains that produce instability and pain might indicate a torn ligament
- Initiate treatment with RICES
  - Rest
  - Ice
  - Compression
  - Elevation
  - Stabilization.

IMPROVISED EQUIPMENT



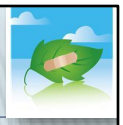
- Walking Splint for Knee injuries:
- Prohibit walking without a supportive knee immobilizer in place
- Many people can still walk out with some additional support
  - If the knee still buckles and/or feels unstable with weight even with a stabilizer – the victim should be evacuated without walking.

IMPROVISED EQUIPMENT



- Walking Splint for Knee injuries:
- The best case in a knee injury would be to immobilize yet allow enough mobility for the patient to walk out
- Improvise from an ensolite or other pad, tent poles, internal pack frame stays and clothing held together with tape or cloth
- It should extend from mid-thigh down to the mid-calf with an opening for the knee to move.

IMPROVISED EQUIPMENT



- Walking Splint for Knee injuries:
- Improvise a patella tendon band with a rolled bandanna or triangular bandage tightly
- Wrap this around the leg just below the kneecap and tie it securely.

WILDERNESS SPLINTING

- Improvised splinting materials
  - Wood pieces
  - Magazines
  - Tools
  - Bulky clothing
  - Flagging
  - Duct tape
  - IAP
- The list is endless.

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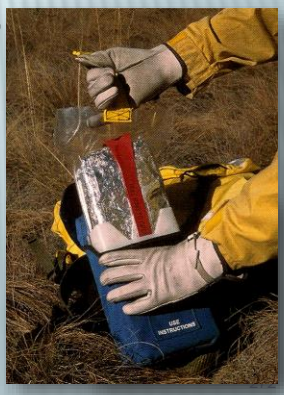
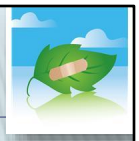
IMPROVISED SPLINTS

- Use what you have:
  1. Something rigid
  2. Something for padding
  3. Something to hold it together
- *And don't forget to think about using…*



IMPROVISED SPLINTS



- *All fractures:*
- Remember to check CSM before you do anything!
- Severely angulated fractures: If there is diminished CSM, gently align the limb to the anatomical position
  - This will generally restore circulation.

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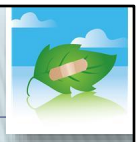
IMPROVISED SPLINTS



- *Open fractures:*
- Control the bleeding, then prepare for splinting
- After thorough irrigation of the wound, pull gently on the limb below the fracture site in a direction which straightens it while someone else holds counter traction on the limb above the fracture.

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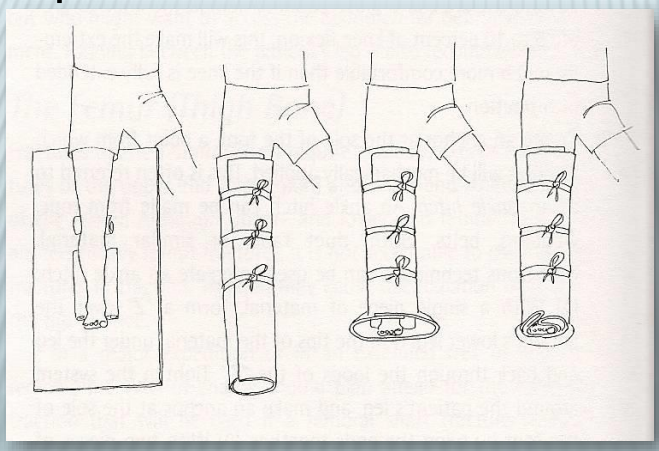
IMPROVISED SPLINTING

- Improvised sling and swathe with shirt.

IMPROVISE: don't have safety pins? Put a pinch of dirt in one corner of the cloth and tie a knot to form a "button"

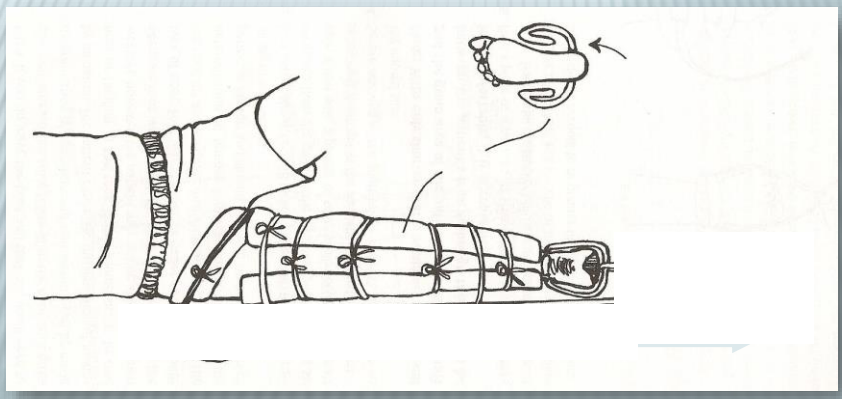
IMPROVISED SPLINTING

- Improvised lower leg splint – sleeping bag or pad.



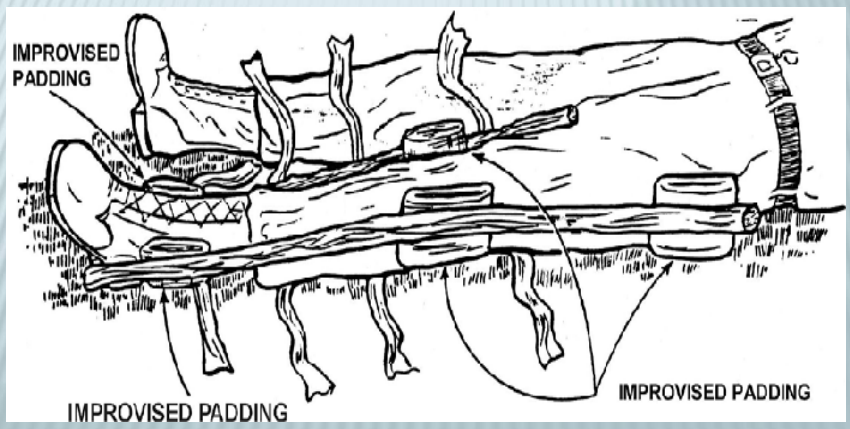
SPLINTING

- Another way to roll the pad
- Tie with flagging or cravats.

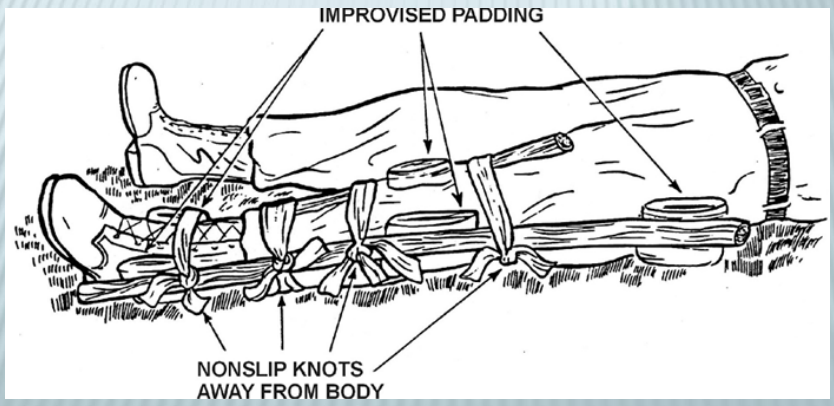


POSITIONING SPLINT AND PADDING

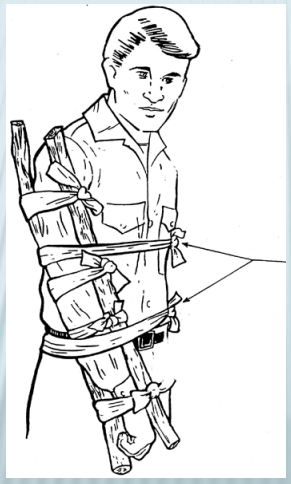
- Padding is essential.



TIE NONSLIP KNOTS

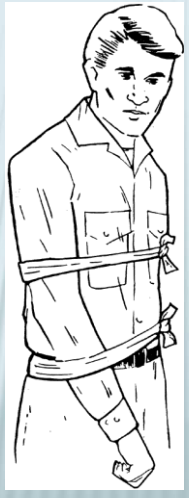


IMMOBILIZED ELBOW FRACTURE OR DISLOCATION

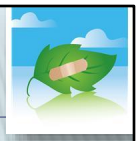


Swathes

IMMOBILIZE UNSPLINTED EXTREMITY

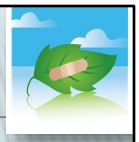


SPLINTING-PELVIS FRACTURE



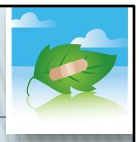
- Improvise a pelvis stabilizer with a sheet or blanket
- Slide under the hips and center under the body
- Cross the cloth over the front of the pelvis and tighten the sling by pulling both ends and securing with a knot
- Consider using a stick for a windlass to tighten.

SPLINTING-TRACTION



- A traction splint is used for a mid-shaft femur fracture
- Scientific studies have shown NO difference between commercial traction splints (Hare, Sager) and improvised.

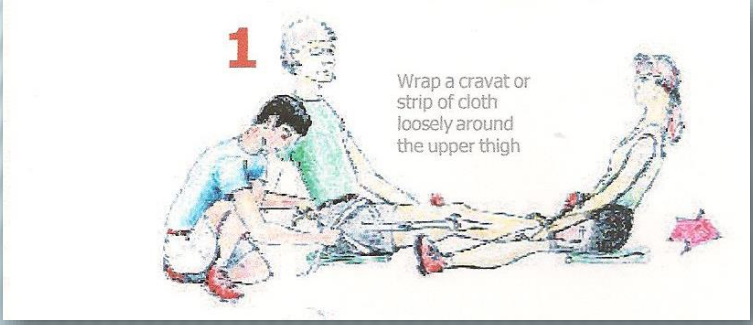
SPLINTING-TRACTION



- A traction splint is used when there is no evidence of pelvic, hip or knee injury
- Traction re-establishes circulation, slows bleeding, relieves pain, prevents a closed fracture from becoming an open one, and prevents further soft tissue injuries
- In an ideal world, someone is placed for manual traction, and will not release until mechanical traction takes over:
  - 10% of the patient's body weight, or until the legs are the same length (about ten pounds).

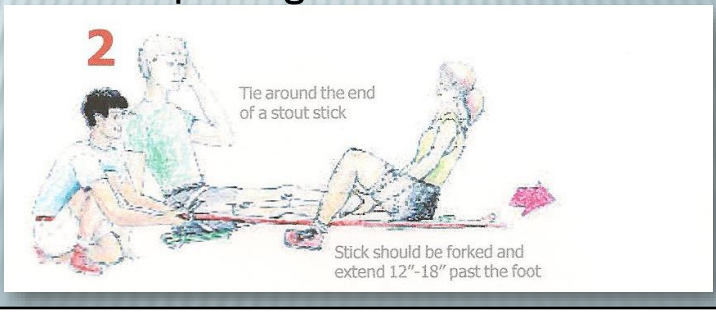
SPLINTING-TRACTION

- Hold about ten pounds of manual traction
  - The patient will tell you when it is enough (massive relief of pain)
- Place and pad a groin strap.



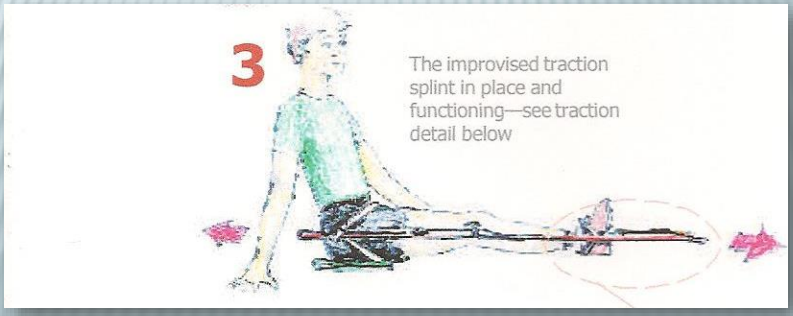
SPLINTING-TRACTION

- Use a stick/tool 12-18” longer than the “good” leg
- Tie off at the top – use a cup, cloth shoe, etc
  - Use lots of padding.



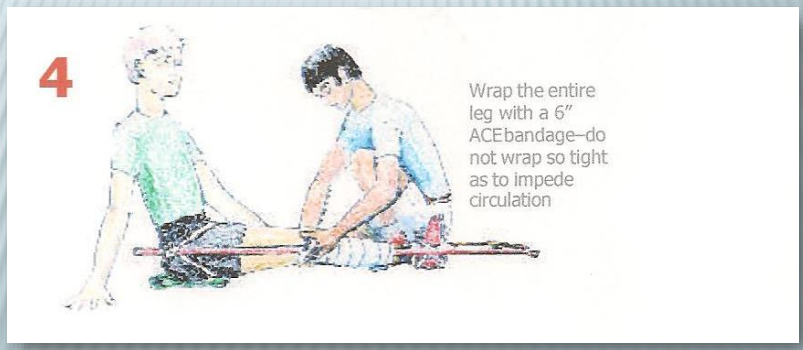
SPLINTING-TRACTION

- Tie an ankle hitch (“S” or “Z” hitch) over boot
- Tie-off to the splint maintaining traction pull.

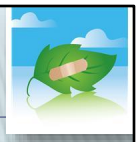


SPLINTING-TRACTION

- Pad and wrap the leg to prevent loss of traction.

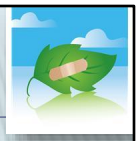


WITHOUT A STETHOSCOPE



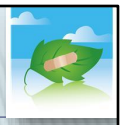
- If a stethoscope is not available, primitive chest auscultation can be performed using a rolled piece of cardboard or paper.
- Any cylinder that can transmit sound through a column of air accentuates breath sounds when placed against the chest wall.
- The absence of sounds normally produced by the air movement indicates blockage in the airways or abnormal filtering of sound by fluid surrounding the lung.
- In the trauma victim, this is invariably associated with pneumothorax or hemothorax..

WITHOUT A STETHOSCOPE



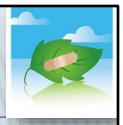
- Vocal fremitus describes vibrations transmitted through the chest wall.
- Diminished vocal fremitus is associated with pneumothorax or hemothorax (blood in the space around the lungs).
- To test for vocal fremitus, the examiner applies the palm of the examining hand against the person's anterior chest wall.
- The person is asked to repeat "one, two, three" using the same pitch and intensity of voice with each repetition.
- If the vibrations are not well perceived, the patient is asked to lower the pitch of the voice.
- The chest should be symmetric, left to right.

WILDERNESS TOOLS AND SUPPLIES



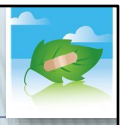
- Tape:
- Carry some form of strong, sticky, waterproof tape. (This item cannot be improvised.)
- Use either cloth adhesive tape (already in the medical kit) or duct tape.
- Duct tape is ideal for almost all tasks, even being useful on skin when needed (e.g., to close wounds, treat blisters, or tape an ankle).
- Some persons may be sensitive to the adhesive.

WILDERNESS TOOLS AND SUPPLIES



- Safety pins:
- Using two safety pins to pin the anterior aspect of the tongue to the lower lip to establish an airway in an unconscious victim whose airway is obstructed
- Replacing the lost screw in a pair of eyeglasses to prevent the lens from falling out

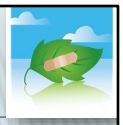
WILDERNESS TOOLS AND SUPPLIES



Safety Pin:

- Neurosensory skin testing
- Puncturing plastic bags for irrigation of wounds
- Removing embedded foreign bodies from the skin
- Draining an abscess or blister
- Relieving a subungual hematoma
- As a fishhook
- As a finger splint (mallet finger).

WILDERNESS TOOLS AND SUPPLIES



- As a sewing needle, using dental floss as thread
- Holding gaping wounds together
- Unclogging jets in a camping stove
- Pinning triage notes to multiple victims
- Removing a corneal foreign body (with ophthalmic anesthetic)
- In a sling and swath for shoulder or arm injuries
- To pin a strap or shirt tightly around the chest for rib fracture support
- Tick removal.

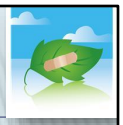
WILDERNESS TOOLS AND SUPPLIES

- **SAM Splint:**
  - Probably the most versatile piece of equipment you could pack
  - When a curve or fold is placed anywhere across its longitudinal axis, it becomes rigid and suitable for splinting almost any bone on the body. Always use curves to add strength and rigidity to the SAM Splint.
  - The basic C-Curve meets most splinting needs.

WILDERNESS TOOLS AND SUPPLIES

- SAM Splint:
- Can be used for:
  - Fingers/hand
  - Upper /lower arm
  - Upper/lower leg / ankle
  - Cervical collar
  - Head bed
  - Impaled objects
  - etc.

SUMMARY



- If you don't have "something":
  - Look at what you need,
  - Look around at what you have
  - Improvise..
  - The possibilities *should be* unlimited.