Accidental Hypothermia and the EMS Provider

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Goals:

1) Review the physiology and pathophysiology of acciental hypothermia.
2) Attempt to make sense of the literature regarding the EMS care of various severities of hypothermia.
3) Temper the textbook answers with what I feel is a real life approach to these patients in EMS.
4) Emphasize BLS care issues- a bit of ALS stuff at the end.
5) Avoid putting you to sleep.
6) Non-goals: drowning; submersion/acute hypothermia; avalanche victims; or metabolic/endocrine/sepsis/drug induced hypothermia.

First, a caveat:

Hypothermia in the EMS environment can range from patients in a “wilderness” or remote environment requiring actual evacuation to your ambulance, to a drunk in the park, to an elder living in a poorly heated home.

Compound that with the lack of clear evidence as to how to best field assess and treat some hypothermics, and we have a topic which is filled with question marks.

The most textbooks, or EMS protocols, can hope to do is lay out a generally accepted approach to hypothermia, and then trust to your judgment and capabilities given the unique situations you find yourself in when caring for this disorder.

A take-home theme:

Field temperatures are difficult to obtain, and are notoriously unreliable anyway. Treat your patients symptoms, not a number.

I say this because…

Textbooks, the AHA, and EMS Medical Directors (myself included!) love to use a nice, warm, dry page in a book to tell you to base your care on a patients “core” temperature.

This is commonly not feasible. “Many providers do not have the time or equipment to assess core body temperature or to institute aggressive rewarming techniques, although these methods should be initiated when available.” *2010 American Heart Association Guidelines for Cardiopulmonary Resuscitation and Emergency Cardiovascular Care*

A few definitions/key points:

- Hypothermia defined as core temp <35˚C (95˚F).
- “Mild” hypothermia→ >34˚C (≈93F).
- “Moderate” hypothermia→ 30-34˚C (≈86-93F).
- “Severe” hypothermia→ <30˚C (86˚F).

A few (more) definitions/key points:

- Most accidental hypothermia deaths occur at air temperatures of 30-50˚F (not that cold).
- ≈ 700 deaths a year in the US.
- Half those who die each year are older than 65 years.
- Extremes of age are especially susceptible.
- Those with an altered LOC are especially susceptible.
- In the US the majority of hypothermic patients are intoxicated with ethanol or other drugs.

It turns out alcohol intoxication is a useful paradigm for thinking about hypothermia…

Pathophysiology:

"Early" hypothermia:

Excitation Stage- Body attempts to retain heat and generate heat via

1. Vaso-constriction (conserve heat);
2. Shivering (production of heat);
3. Increased metabolic rate.

Shivering Mini-course

- Increases heat production by as much as 500%.
- Probably most effective field rewarming tool we have.
- But: takes a lot of sugar to sustain it.
- So: feed the beast, if their LOC/airway can tolerate it.
- Warm, sweet liquids... hot Jello is what I always used.

Pathophysiology…

"Later" hypothermia:

Slowing (adynamic) Stage- Progressive slow-down of all bodily functions and metabolism

1. O2 use and CO2 production fall;
2. sugar stores become depleted;
3. shivering ceases→ with LOC right behind it;
4. HR and BP fall (may become undetectable);
5. death.

Mt. Hood Medical After-Action Committee

"LOC is a rough, but reliable, indicator of the severity of hypothermia".

So, where are we now?

Clinically (who knows what their "core" temp is) we could think like this:

Early Hypothermia: Hyperdynamic; alive; trying to compensate and rewarm themselves (shivering); has vital signs; somewhat alert.

- Need us to recognize their disease, and provide aggressive supportive/rewarming measures and evacuation to the ED

Later Hypothermia: Adynamic; obtunded; no longer compensating; significantly abnormal VS; maybe "dead".

- Needs aggressive ABC eval, with possible BLS/ALS interventions, while we provide aggressive supportive/rewarming measures and evacuation to the ED.

Treatment:

Are there issues other than hypothermia on the table?

- Trauma?
- Frostbite?
- Drowning/submersion?
- Intoxication?
- Underlying medical problem?

"Hypothermia is frequently preceded by other disorders (eg, drug overdose, alcohol use, or trauma), the EMT must look for and treat these underlying conditions while simultaneously treating hypothermia." *2010 American Heart Association Guidelines for Cardiopulmonary Resuscitation and Emergency Cardiovascular Care*

General Supportive Treatment:

Early Hypothermia

Signs and Symptoms:
Conscious
Shivering
Dis-coordinated
Slurred speech
Poor Judgement

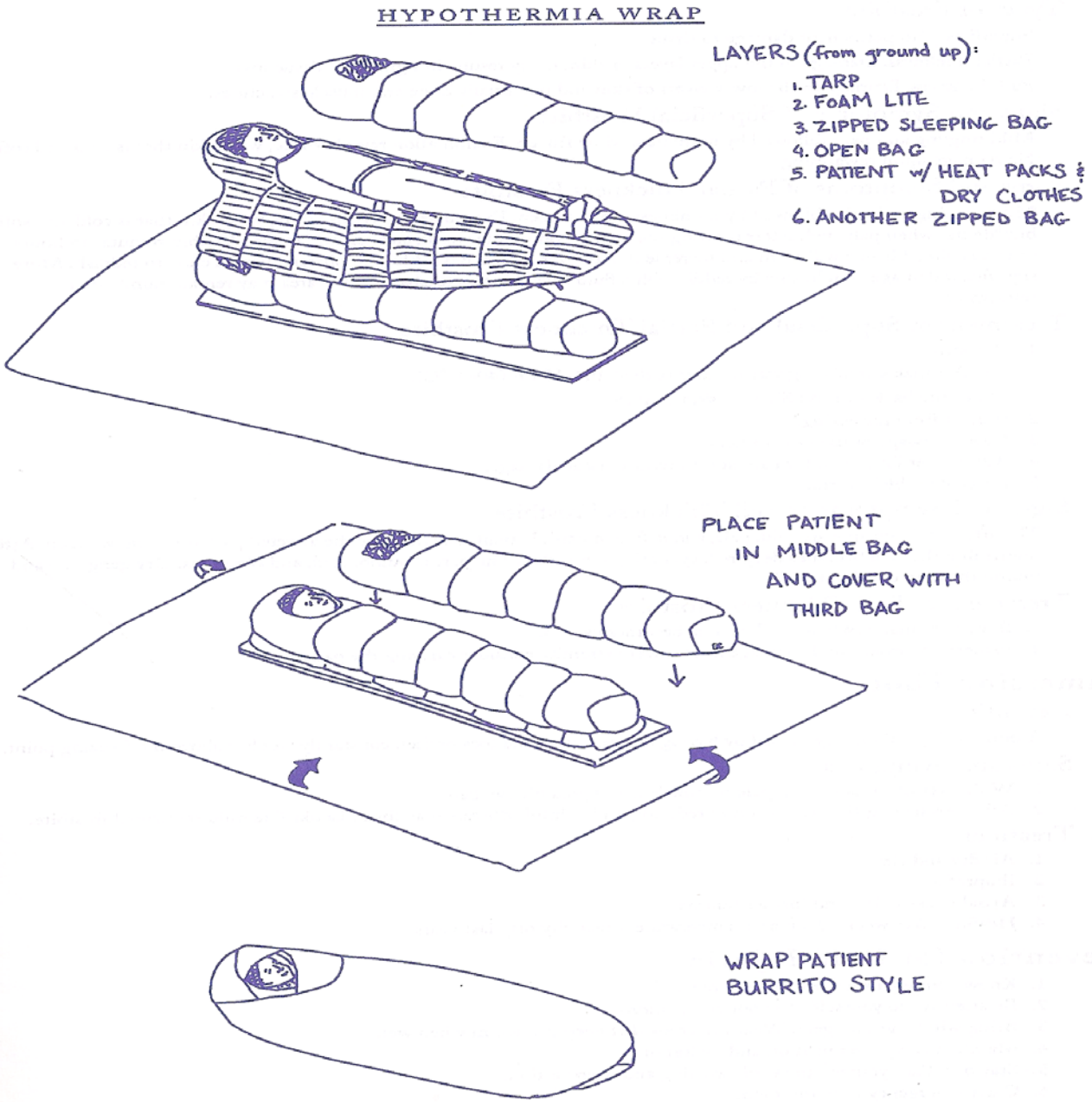
Treatment:
Change their environment
→ DRY!!
Warm, sweet liquids
Carbohydrates
External heat
"Hypothermia wrap"

Later Hypothermia:

Signs and Symptoms:
Profoundly altered LOC
Non-shivering
Abnormal/absent VS
Cold, ridged, "dead"

Treatment:
Change their environment
→ DRY!!
External heat
"Hypothermia wrap"

“Hypothermia Wrap”



Treatment

Hypothermia with Signs of Life

Pulse or Respirations

If “Early” Hypothermia:

1. Cardiac instability unlikely; monitor, SaO2, EKG.
2. General treatment as per previous slides.
3. Heated, humidified O2, if available.
4. IV with warm IVF, if available.
5. Check BG, and treat per local protocol.
6. If patient arrest, treat as per normothermic protocols.

If “Later” Hypothermia:

1. Handle as gently as possible- prone to arrhythmias.
2. BVM or intubation as necessary, with h/h O2 if available.
3. In general, rhythms which give a pulse (even if fast or slow) are treated only with rewarming.
4. It is suggested you take 30-60 seconds to carefully assess for respirations and pulse, before determining no signs of life.

Treatment

Hypothermia Without Signs of Life

No Pulse or Respirations detectable

- BLS/ALS algorithms may be modified in hypothermia without signs of life.
- Ideally the patient is in the hospital and rewarmed before resuscitation is stopped.
- The EDP may request extended care and transport.

Do not initiate resuscitation if:

1. S/s of obvious death: rigor, livor, decapitation, decomposition, etc.
2. Body is frozen (not just extremity frostbite), such as:
   a) ice formation in mouth/airway, or
   b) unable to compress chest.
3. Rescuer exhaustion, or rescuer safety jeopardized, by resuscitation efforts.

Treatment

Hypothermia Without Signs of Life

No Pulse or Respirations detectable

BLS Care Guidelines:

1. Carefully assess for breathing/pulse for 30-60 seconds.
2. Ventilate at ½ the normal rate; h/h O2 if available.
3. If no pulse, begin CPR immediately.
4. If VT or VF is present, defibrillation should be attempted.

"The temperature at which defibrillation should first be attempted in the severely hypothermic patient and the number of defibrillation attempts that should be made have not been established."

"In a recent animal model it was found that an animal with a temperature of as low as 30°C had a better response to defibrillation than did normothermic animals in arrest."

"If VT or VF persists after a single shock, the value of deferring subsequent defibrillations until a target temperature is achieved is uncertain."

"It may be reasonable to perform further defibrillation attempts according to the standard BLS algorithm concurrent with rewarming strategies."

Treatment

Hypothermia Without Signs of Life

No Pulse or Respirations detectable

Current Mesa County EMS Protocol- as an example

ALL EMT'S: MODIFICATIONS TO BLS CARE

1. Carefully assess for breathing and pulse for **30-45 seconds**.
2. Perform rescue breathing if no respirations detected:
    a. Use **warm O2 (108-115F)** during BVM ventilation, if available.
    b. Ventilate at **half the usual rate** per minute.
3. If no pulse- begin **CPR**.
4. If AED available, attach to patient and analyze:
    a. If core temp **known** to be **below 30C (86F)**:
        i. give one (1) shock if AED instructs you to do so.
        ii. **no further shocks** until core temperature 30C/86F or above.
    b. If core temp **known** to be **30C (86F) or above**:
        i. follow resuscitation guidelines as if patient is normothermic.
    c. If core **temperature unknown**:
        i. 3 shock maximum (if AED instructs), unless EDP authorizes more shocks.

Treatment

Hypothermia Without Signs of Life

No Pulse or Respirations detectable

ALS Care Guidelines:

1. Intubate patient-
   a. ventilate at ½ the normal rate; use h/h O2 if available.
2. Follow BLS Care/defibrillation guidelines.
3. ACLS management of hypothermic arrest focuses on aggressive rewarming techniques as the primary treatment.
4. The cold heart may be unresponsive to drugs, pacing, and defibrillation- the data to support this are theoretical.
5. Drug metabolism may be reduced, and medications could accumulate to toxic levels in the peripheral circulation if given repeatedly- the data to support this are theoretical.
6. Historically guidelines suggest withholding IV drugs if the victim's core body temperature is <30°C (86°F).

Treatment

Hypothermia Without Signs of Life

No Pulse or Respirations detectable

Current Mesa County EMS Protocol- as an example

MODIFICATIONS TO ALS CARE

1. Follow all guidelines under “Modifications to BLS Care” above.
2. Intubate patient:
   a. Use warm O2 (108-115F) during BVM ventilation, if available.
   b. Ventilate at half the usual rate per minute.
3. Defibrillation as under BLS Care Guidelines above.
4. ACLS medications:
   a. Cold heart may not respond to drugs/shocks.
   b. Focus is on aggressive rewarming and rapid transport.
   c. If core temp **known** to be **below 30C (86F):**
      i. Medications should generally be held until core temp. >30C.
   d. If core temp **known** to be **30C (86F) or above**:
      i. follow resuscitation guidelines as if patient is normothermic.
   e. If core **temperature unknown**:
      i. BLS care and call EDP if possible. Use your judgement if EDP not reachable.

Treatment

Hypothermia Without Signs of Life

No Pulse or Respirations detectable

Some 2010 AHA/ECC goodies:

"In the last decade a number of animal investigations have been performed evaluating both vasopressors and antiarrhythmic medications that could challenge some of this conventional wisdom."

An analysis of these studies found that epinephrine or vasopressin "increased rates of return of spontaneous circulation (ROSC) when compared with placebo ."

But animals given antiarrhythmics "showed no improvement in return of spontaneous circulation (ROSC)."

One small-animal investigation suggested that the application of standard ACLS algorithms using both epinepherine and defibrillation improved ROSC .

"Given the lack of human evidence and relatively small number of animal investigations, the recommendation for administration or withholding of medications is not clear."

"It may be reasonable to consider administration of a vasopressor during cardiac arrest according to the standard ACLS algorithm concurrent with rewarming".

Treatment

Hypothermia Without Signs of Life

No Pulse or Respirations detectable

So, where are we now?:

Rewarming, CPR, airway management, BG, monitor, EKG, IVF?

→ YES, unequivocal.

Defibrillation?

→ probably YES- ?helpful based on recent studies.

→ Limit number of shocks if not effective (3)?

→ Some literature supports following “standard BLS defibrillation algorithm”.

Vasopressors (epi/vasopressin)?

→ probably YES- ?helpful based on recent studies.

→ One study suggests use of vasopressor and defib. increases ROSC.

→ consider use of a vasopressor per the standard ACLS algorithm.

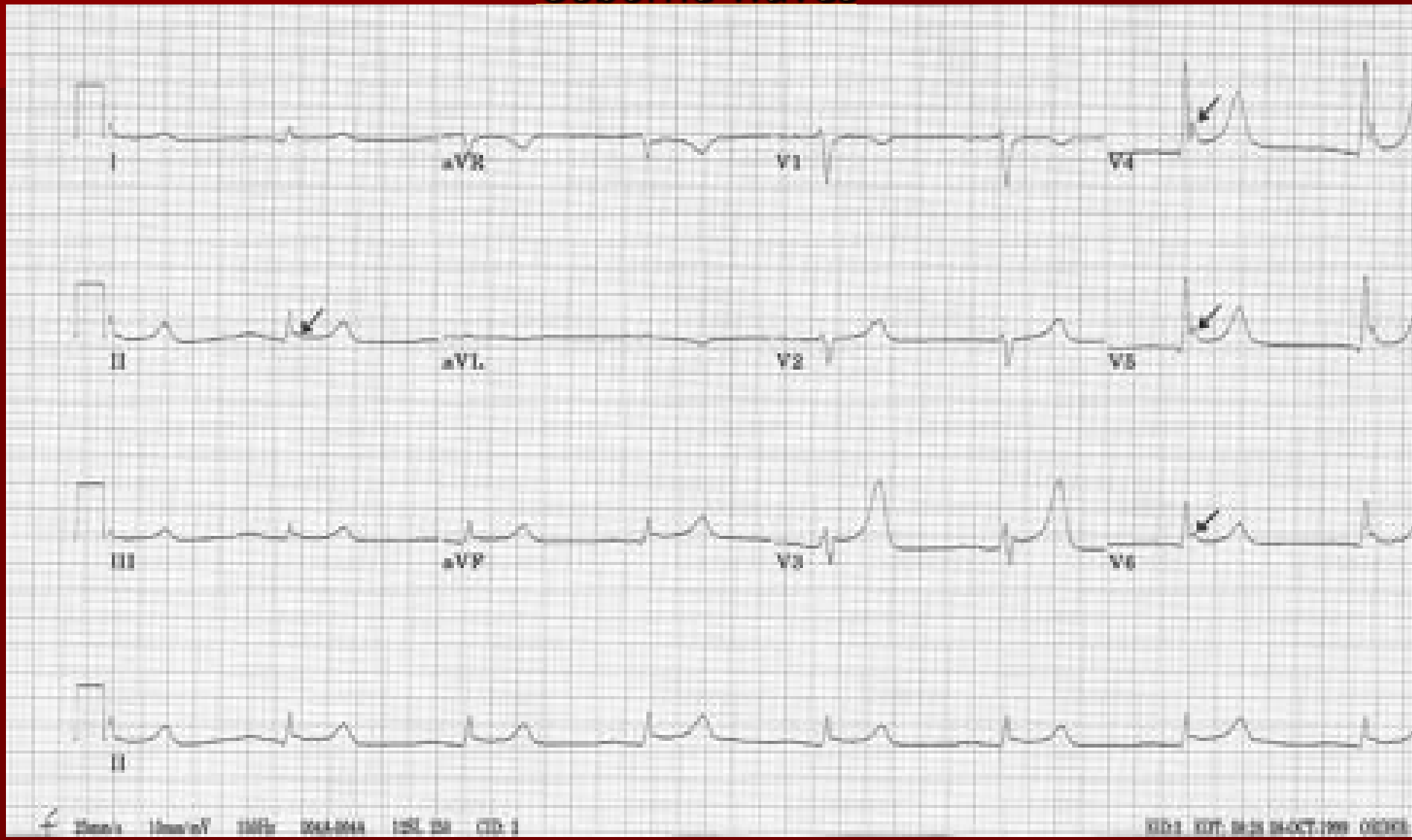
Antiarrhythmics?

→ seems like NO…ish.

→ no benefit in ROSC seen in limited studies done.

Hypothermic EKG

Osborne waves



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