



## UTSW/BioTel EMS TRAINING BULLETIN January 2015

### EMS TB 15-001 Accidental Hypothermia

**Purpose:**

1. To provide patient assessment and management guidance to UTSW/BioTel EMS Providers about Accidental Hypothermia

**Background and Definition:**

1. Definition: an involuntary drop in core (internal) body temperature to 35°C (95°F) or less
  - a. Primary: excessive cold overcomes heat production in an otherwise healthy person
  - b. Secondary: caused by many medical conditions\*, *even in a warm environment*
2. Resuscitation outcomes can be favorable in many cases, even after prolonged “down time”
  - a. Death in secondary hypothermia is often caused by the underlying condition
3. Patient care goals: maintain hemodynamic stability, prevent further heat loss, aggressively resuscitate cardiac arrest and prevent limb loss (due to associated local cold injury)

**Diagnosis and Clinical Features:**

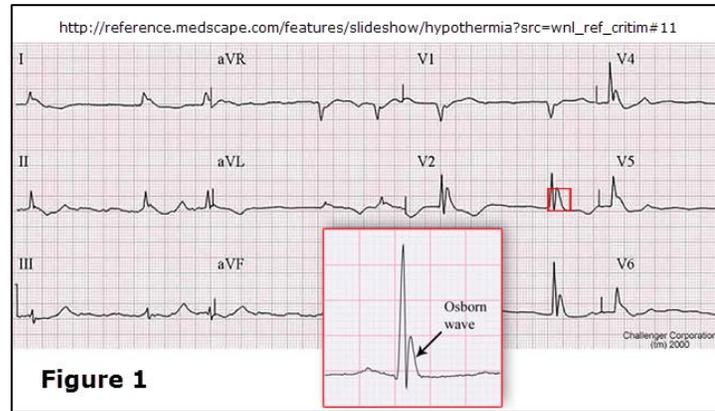
1. **Diagnostic Criteria:**
  - a. History of cold exposure **OR** a predisposing disease/risk factor\* **AND**
  - b. Cold torso **OR** core (internal) temperature less than 35°C (95°F)
2. **Core temperature cannot be measured by EMS, so use this clinical staging table:**

Table 1 – Clinical Staging of Accidental Hypothermia <sup>†</sup>		
Stage	Cold Torso + These Signs and Symptoms	Typical Core Temperature
I	Conscious, shivering	35 to 32°C (95 to 90°F)
II	Impaired consciousness, not shivering	Less than 32 to 28°C (Less than 90 to 82°F)
III	Unconscious, not shivering, vital signs present	Less than 28 to 24°C (Less than 82 to 75°F)
IV	No vital signs, fixed and dilated pupils	Less than 24°C (Less than 75°F)

<sup>†</sup>Adapted from Brown DJA, et al. 2012. NEJM 367:20; 1930-1938.

\*Refer to the Table of Secondary Conditions (Table 3) on page 5

3. **ECG Findings – Slow cardiac conduction causes a range of dysrhythmias, such as:**
- Sinus bradycardia and AV nodal block – generally resolve with rewarming
  - Atrial fibrillation: common at core temperature less than 32°C (90°F)
  - Osborn (J) waves: 80% of patients with core temperature less than 30°C (86°F)
    - Late, small wave after the QRS in leads II, III, aVR, aVF & V3-V6 (Figure 1):



- Cardiac arrest: greatest risk in Stage III (core temperature less than 28°C (82°F))
  - “Rescue Collapse”:
    - Causes: Hypovolemia, dysrhythmias triggered by patient movement (ventricular fibrillation leading to asystole) and continued cooling

### Pre-Hospital Patient Care and Transport:

- NOTE: Careful handling – minimize patient movements**
  - Patients in Stage II or III should NOT be permitted to stand, ambulate or exercise, in order to reduce risk of cardiac dysrhythmias and circulatory collapse
- NOTE: Detection of palpable pulse is difficult – check for signs of life/pulse for at least 60 seconds**
- General Principles:**
  - Apply continuous ECG, SpO<sub>2</sub> and ETCO<sub>2</sub> monitoring
  - Obtain and document frequent vital signs, including GCS and POC Glucose:
    - Treat hypoglycemia per ALTERED LOC Treatment Guidelines
  - Document the patient’s initial temperature and the ambient temperature (if known):
    - Do not interrupt or delay treatment or transport for repeat measurements
    - Core cooling may continue after rescue, once peripheral, active, external rewarming of cold extremities has begun – this is called “Afterdrop”
  - Apply supplemental oxygen (warmed, if possible) to maintain SpO<sub>2</sub> at least 94%
  - Treat only hemodynamically significant dysrhythmias (e.g. ventricular fibrillation and pulseless ventricular tachycardia) and cardiac arrest – Refer to Figure 2 (page 3):
    - Sinus bradycardia: consider pacing ONLY if hemodynamic compromise persists *after rewarming*
    - VF/pVT: up to 3 defibrillation attempts & 3 doses of epinephrine, as needed
  - Establish IV/IO access, but avoid excessive infusions of cold fluids
  - Treat associated and underlying condition(s) (Table 3, page 5), including Cardiac Arrest, per standard UTSW/BioTel EMS Treatment Guidelines

#### 4. Pre-Hospital Patient Care and Transport Overview (Figure 2):

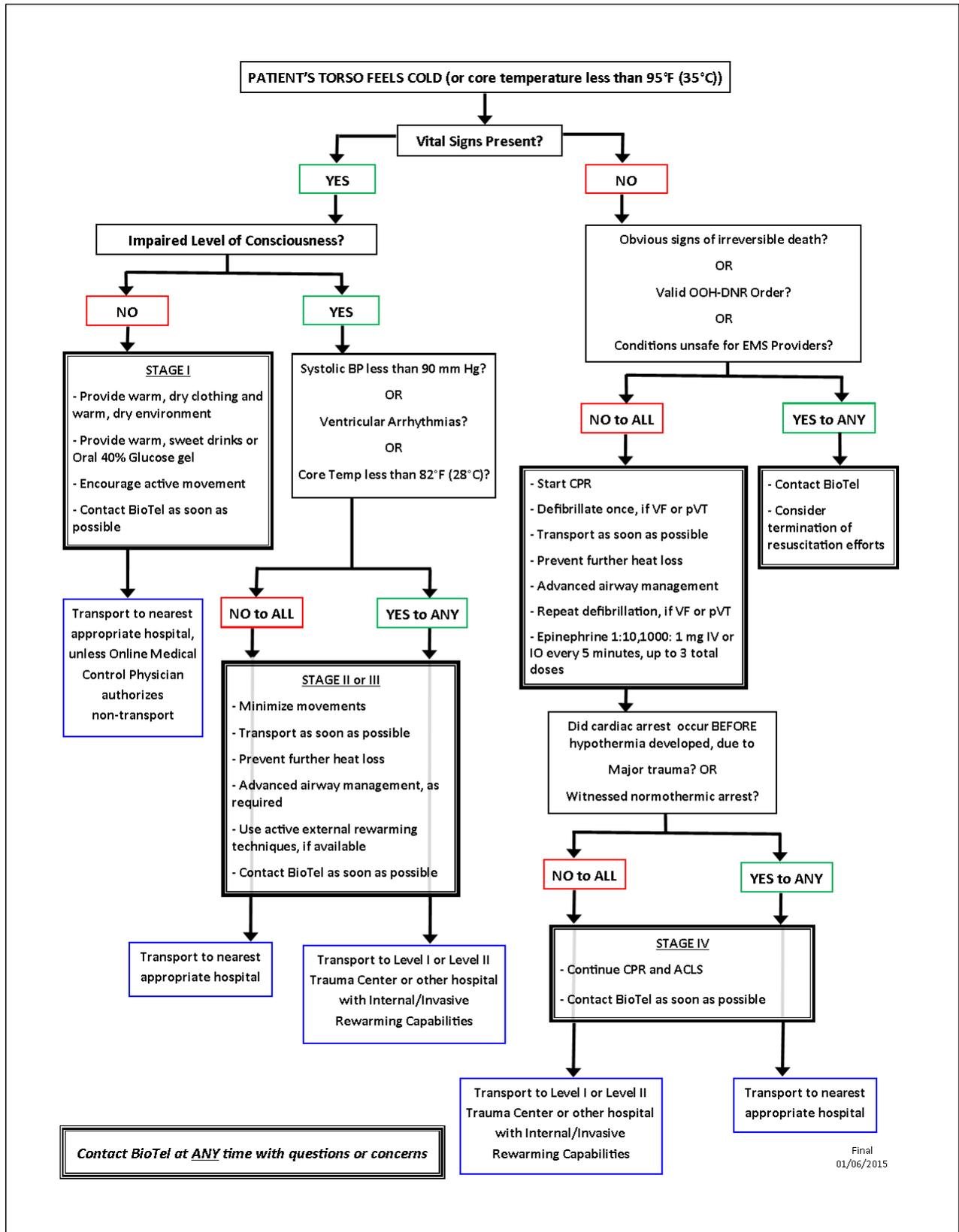


Figure 2 - Adapted from Brown et al. 2012. NEJM 367:20; 1930-1938.

**5. Methods for Passive Rewarming and Prevention of Further Heat Loss:**

<b>Table 2 – Rewarming Methods for Accidental Hypothermia</b>	
<b><u>Pre-Hospital</u></b>	<b><u>Hospital</u></b>
<b>Passive</b>	<b>Active – External</b>
Dry Patient	Heating Pad, Warm Water Bottles
Shelter from wind and wet conditions, insulate from ground	Immersion in Warm Bath
Move patient to warm environment	External Convection Heaters (e.g. Lamps)
Blanket or Clothing Insulation	Forced Air Warming Blankets (Bair Hugger®)
Head Cover	<b>Active – Internal (See Appendix)</b>
Heat Packs, Warm Water Bottles, if available	Catheter, Body Cavity Lavage, Peritoneal Dialysis
Shivering: increases heat production, but requires caloric replacement (if possible)	<b>Extracorporeal Rewarming (See Appendix)</b>
Provide warm, sweet drinks or 40% oral glucose gel to alert patients with normal airway	ECMO, Cardiopulmonary Bypass, Hemodialysis

**6. Special Considerations:**

**a. Contraindications for initiating resuscitation in the hypothermic patient:**

- i. Submersion greater than 1 hour
- ii. Core temperature less than 10°C (50°F)
- iii. Obvious fatal injuries, such as decapitation
- iv. Ice formation in the airway and other signs of total body tissue freezing
- v. Chest wall rigidity that renders chest compressions impossible
- vi. Valid Out-of-Hospital DNR Order
- vii. Dangers to EMS Providers or other rescuers

**b. Additive Effect of Major Trauma:**

- i. Trauma, shock and cerebrospinal injury increase risk of hypothermia
- ii. Hypothermia increases bleeding, transfusion requirement and mortality
- iii. Refer to the **TRAUMA** Treatment Guidelines

**c. Submersion/Drowning:**

- i. Cold water submersion: outcome may be more favorable than warm water
- ii. Continue resuscitation if submersion time is less than 60 minutes or unknown *and* there are no contraindications to resuscitation (Section 6a, above)

**d. Associated Local Cold Injury, e.g. Frostbite:**

- i. Remove clothing, footwear, jewelry and other constricting items
- ii. Initiate rewarming, if feasible, **ONLY** if refreezing is absolutely preventable
  1. Do not allow tissue to refreeze!
- iii. Cover injured parts with a loose, dry sterile dressing
  1. Do not open or drain intact blisters
  2. Do not rub the injured part to stimulate circulation
- iv. Maintain affected body part at heart level:
  1. Do not elevate or allow limb to dangle
- v. Refer to the **PAIN MANAGEMENT** Treatment Guidelines

### Destination Decision-Making – Consult BioTel or Hospital Capabilities Matrix:

1. **Stage I (Conscious, shivering and no other signs/symptoms):** Nearest appropriate hospital, unless the Online Medical Control Physician advises otherwise
2. **Stage II (Impaired consciousness or not shivering):**
  - a. **Normal BP, no dysrhythmia and core temp at least 28°C (82°F):** Nearest appropriate hospital
  - b. **Hypotension or dysrhythmia or core temp less than 28°C (82°F):** Level I or Level II Trauma Center, or a hospital capable of internal/invasive rewarming
3. **Stage III (Unconscious, not shivering and vital signs present):** Level I or Level II Trauma Center, or a hospital capable of internal/invasive rewarming
4. **Stage IV (Absent vital signs, CPR):** Level I or Level II Trauma Center, or a hospital capable of internal/invasive rewarming
  - a. Exception: nearest appropriate hospital *IF* cardiac arrest occurred *before* hypothermia developed, e.g. due to trauma or witnessed normothermic arrest

### Critical Documentation Items:

1. Duration of cold exposure, ambient temperature at time of EMS contact, and rewarming attempts or other therapies performed prior to EMS arrival
2. Cardiac dysrhythmias and treatment and associated trauma (when present)

<b><u>Impaired Thermoregulation</u></b>	<b><u>Increased Heat Loss</u></b>
Central Nervous System Disease, e.g. Stroke	Multi-System Trauma
Central Nervous System Trauma	Shock
Spinal Cord Transection	Burns
Extremes of age: Newly Born and Elderly	Cardiopulmonary Disease
Alcoholic or Diabetic Ketoacidosis	Major Infection (bacterial or viral or parasitic)
Lactic Acidosis	Emergency Childbirth
Hypoglycemia	Cold IV or IO Infusions
Extreme Physical Exertion	Heat-Stroke Treatment
Malnutrition	Disseminated Cancer
Hypothyroidism and Other Endocrine Diseases	Medication- and Toxin-Induced Skin Diseases
Impaired Shivering	

<sup>†</sup>Adapted from Brown DJA et al. 2012. NEJM 367:20; 1930-1938.

### Summary:

1. EMS Providers must screen for accidental hypothermia, even in a relatively warm environment, especially in patients with a wide range of conditions and diseases (Table 3)
2. Patient care goals: maintain hemodynamic stability, prevent further heat loss, aggressively resuscitate cardiac arrest and prevent limb loss
3. Patients with Stage I hypothermia should be transported to the nearest appropriate facility, unless the Online Medical Control Physician advises otherwise

4. Most patients with Stage II and III hypothermia should be transported to a Level I or Level II Trauma Center, or to a hospital capable of internal/invasive rewarming procedures (Consult the Hospital Capabilities Matrix or BioTel for destination assistance)
5. For patients with Stage IV hypothermia and cardiac arrest/CPR due to ventricular fibrillation (VF) or pulseless ventricular tachycardia (pVT), a single defibrillation attempt should be performed on-scene, followed by rapid transport and rewarming:
  - a. CPR and further defibrillation attempts and epinephrine administration should be performed *en route*:
    - i. This differs from standard treatment for normothermic VF/pVT cardiac arrest
    - b. There is no proven benefit for the administration of amiodarone, lidocaine or other anti-arrhythmics in hypothermic arrest due to VF/pVT
6. Patients with Stage IV hypothermia should **NOT** be considered dead until rewarming has been performed at the appropriate receiving hospital:
  - a. Pre-hospital CPR should be withheld or termination of resuscitation efforts should be *considered* **ONLY** if there are obvious signs of irreversible death, there is a valid OOH-DNR order, or conditions are unsafe for EMS Providers
7. Refer to the relevant [UTSW/BioTel EMS Treatment Guidelines and Policies](#), especially the ALTERED LEVEL OF CONSCIOUSNESS, ASYSTOLE/PEA, CARDIAC ARREST, POST-CARDIAC ARREST, TRAUMA and VFIB/pulselessVTACH Treatment Guidelines, and the DESTINATION and DETERMINATION of DEATH Policies
8. **Consult BioTel at any time with questions or concerns**

#### References and Resources:

- Brown DJA, et al. NEJM 2012; 367(20):1930-1938
- Soar J, et al. Resuscitation 2010; 81:1400-1433
- Vanden Hoek TL, et al. Circulation 2010; 122:Suppl 3:S829-S861
- [National Model – EMS Clinical Guidelines \(October 2014\)](#) (accessed 12/28/2014)

#### Appendix – Active Internal and Invasive Rewarming Methods (Refer to Table 2, page 4):

- **Intravascular Temperature Management**
  - **A special central venous catheter** warms the patient by heat exchange, as blood passes over special saline-filled balloons on the catheter in a large vein
  - **Other methods that can be used in special circumstances, if available:**
    - Hemodialysis
    - Venovenous or Venoarterial ECMO (a form of cardiopulmonary bypass)
    - Cardiopulmonary Bypass
- **Other methods:**
  - Infusing warm fluids into the peritoneal or thoracic cavity, stomach or bladder