

# Toxins and Environmental: HEAT- and COLD-RELATED EMERGENCIES

## Accidental Hypothermia/Cold Exposure

**Goal:** To aid EMS Providers in: the recognition and treatment of **systemic effects** of accidental hypothermia and cold exposure, including maintenance of hemodynamic stability, vigorous cardiopulmonary resuscitation, and prevention of further heat loss; and in the recognition and treatment of **localized cold injury** to minimize risk of limb loss

**Inclusion Criteria:** All patients with localized or systemic cold injuries

**Exclusion Criteria:** Patients without cold exposure, or patients with cold exposure with no symptoms referable either to hypothermia or to localized cold injury (such as frostbite)

**Refer to:** [Cardiac Arrest](#), [Asystole/PEA](#), [VFib/Pulseless VTach](#) and [Trauma CPGs](#)

### Definitions:

- Accidental hypothermia: an involuntary drop in core (internal) body temperature to 35°C (95°F) or less
  - Primary: excessive cold overcomes heat production in an otherwise healthy person
  - Secondary: caused by many medical conditions, even in a warm environment (\*refer to **Table 3**)
- Localized cold injury: spectrum of localized tissue damage (usually limbs) associated with cold exposure

### Significance:

- Resuscitation outcomes can be favorable in many cases, even after prolonged “down time”
  - Key factors for hypothermia: level of consciousness, shivering and cardiac stability (BP and rhythm)
- Death in secondary hypothermia is often caused by the underlying condition

### Diagnosis and Clinical Features:

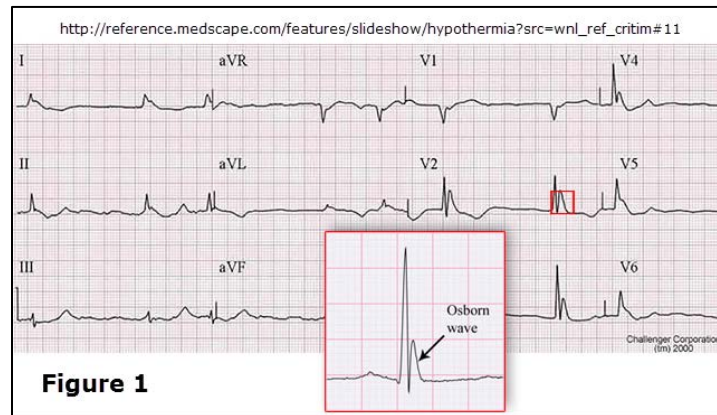
- Diagnostic Criteria:**
  - History of cold exposure **OR** a predisposing disease/risk factor (\*refer to **Table 3**) **AND**
  - Exam: Cold torso **OR** core (internal) temperature less than 35°C (95°F)
- Core temperature cannot be measured by EMS, so **Table 1** should be used for clinical staging:

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. [doi/full/10.1056/nejmra1114208](https://doi.org/10.1056/nejmra1114208)

- ECG and cardiac findings – Slow cardiac conduction, with a range of dysrhythmias, such as:
  - Sinus bradycardia and AV nodal block: these 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)

- i. Late, small wave after QRS in leads II, III, aVR, aVF and V3-V6 (**Figure 1**):



- d. Cardiac arrest: greatest risk in Stage III (core temperature less than 28°C (82°F))
  - i. “Rescue collapse”:
    - 1. Caused by hypovolemia, patient movement (dysrhythmias) and continued cooling

#### Basic Level

1. **NOTE:** Handle patients gently – minimize patient movements to reduce risk of cardiovascular collapse
  - a. Patients in Stage II or III should not be permitted to stand, ambulate or exercise
2. **NOTE:** Detection of a palpable pulse is difficult – check for signs of life/pulse for at least 60 seconds
3. Assess and support ABCs per [UNIVERSAL CARE – ADULT](#) or [UNIVERSAL CARE – PEDIATRIC](#)
  - a. Initiate continuous ECG, SpO<sub>2</sub> and ETCO<sub>2</sub> monitoring
  - b. Obtain and document frequent vital signs, including GCS and POC Glucose analysis
    - i. Treat hypoglycemia according to [Diabetic Emergencies CPG](#)
  - c. Document the patient's initial temperature and ambient temperature (if known)
    - i. Do not interrupt or delay treatment/transport for repeat measurements
    - ii. Core cooling may continue even after rescue, once peripheral, external rewarming of cold extremities has begun – this is called “afterdrop”
  - d. Apply supplemental oxygen (warmed, if possible), to maintain SpO<sub>2</sub> at least 94%
  - e. Follow general patient care and transport guidelines in **Figure 2** (next page)
  - f. Once advanced level care arrives on scene, give report and transfer care

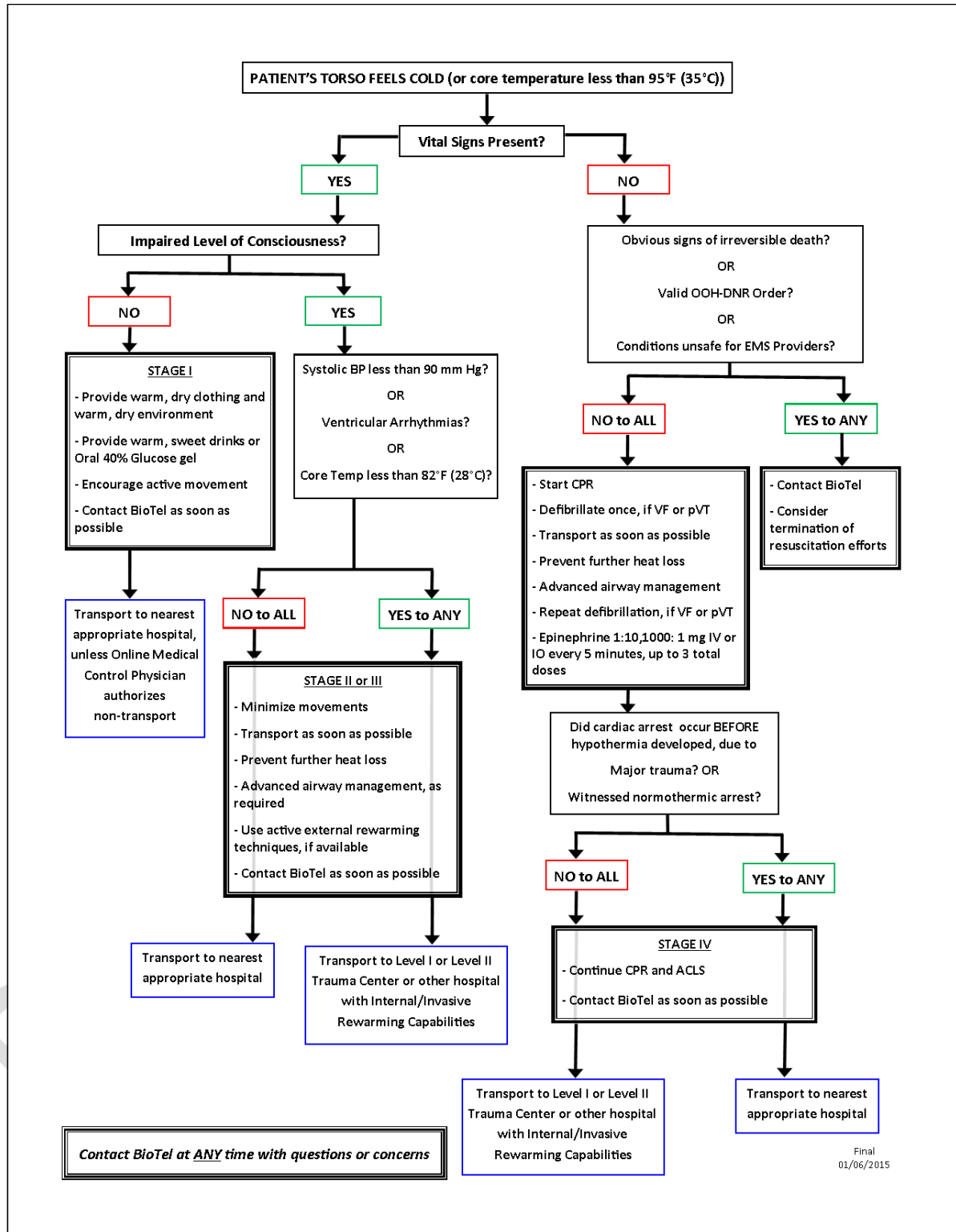
#### Advanced Level:

1. Treat only hemodynamically-significant dysrhythmias (e.g. [VFib and pulseless VTach](#)) and [cardiac arrest](#)
  - a. Sinus bradycardia: consider [transcutaneous pacing \(TCP\)](#) ONLY if hemodynamic compromise persists after rewarming
  - b. [VF/pulseless VT](#): One immediate defibrillation attempt on-scene at maximal settings, then
    - i. CPR and up to two additional defibrillation attempts should be performed *en route*
      1. This differs from standard treatment of normothermic VF/pulseless VTach arrest
    - ii. Consider one dose of IV/IO epinephrine 0.1 mg/mL (repeat doses unlikely to be helpful):
      1. Adults: 1 mg (10 mL) for adults

**1. Pediatric (Infants and children under 14 years of age) - Epinephrine (0.1 mg/mL)**  
Administer 0.01 mg/kg (0.1 mL/kg) IV/IO

- iii. No proven benefit for amiodarone, lidocaine or other anti-arrhythmics
2. Establish IV/IO access, but avoid excessive infusion of cold fluids
3. Continue general patient care and transport guidelines in **Figure 2** (next page)
4. Treat associated and underlying conditions (\*refer to **Table 3**)

5. Pre-Hospital Patient Care and Transport Overview (**Figure 2**) – this needs tweak for revised epi dosing



†Adapted from Brown DJA, et al. 2012. NEJM 367:20; 1930-1938. [doi/full/10.1056/nejmra1114208](https://doi.org/10.1056/nejmra1114208)

6. Methods for Pre-Hospital Passive Rewarming and Prevention of Further Heat Loss (adults only):

Table 2 – Pre-Hospital Passive Rewarming Methods
Dry Patient
Shelter from wind and wet conditions, insulate from ground
Move patient to warm environment
Gentle blanket or clothing Insulation
Head Cover
Heat Packs, Warm Water Bottles, if available
Shivering: increases heat production, but requires caloric replacement (if possible)
Provide warm, sweet drinks or 40% oral glucose gel to alert patients with normal airway

7. 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. Obviously 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 CPG](#)

**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 CPG](#)

**e. Pediatric Considerations – Infants and Children Younger than 14 Years of Age:**

- i. Children are at more risk for accidental hypothermia than adults
  1. This is the result of anatomic, physiologic and developmental factors
  2. Hypothermia may occur at relatively high ambient temperatures
- ii. Parent/caregiver history may be misleading (e.g. cold water punishment may be denied)
- iii. Survival with good neurologic outcome may be more likely than in adults
- iv. **NOTE:** External rewarming should be postponed until E.D. arrival, to avoid “afterdrop”

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

1. **Stage I (Conscious, shivering and no other signs/symptoms):**
  - a. Closest 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): Closest appropriate hospital
  - b. Hypotension, dysrhythmia or core temp less than 28°C (82°F): Level I or Level II Trauma Center
    - i. Alternative: Hospital capable of internal/invasive rewarming
3. **Stage III (Unconscious, not shivering and vital signs present):**
  - a. Level I or Level II Trauma Center
    - i. Alternative: Hospital capable of internal/invasive rewarming
4. **Stage IV (Absent vital signs, CPR):**
  - a. Level I or Level II Trauma Center
    - i. Alternative: Hospital capable of internal/invasive rewarming
  - b. EXCEPTION: Closest 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 the time of EMS contact, and rewarming attempts or other therapies performed prior to EMS arrival
2. Cardiac dysrhythmias (when present) and treatment; associated trauma (when present) and treatment

### Appendix:

Table 3 – Examples of Conditions Associated with Secondary Hypothermia <sup>†</sup>	
<u>Impaired Thermoregulation</u>	<u>Increased Heat Loss</u>
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	

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