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:**

1. Accidental hypothermia: 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 (*refer to Table 3)

2. Localized cold injury: spectrum of localized tissue damage (usually limbs) associated with cold exposure

**Significance:**

1. Resuscitation outcomes can be favorable in many cases, even after prolonged “down time”
   a. Key factors for hypothermia: level of consciousness, shivering and cardiac stability (BP and rhythm)

2. Death in secondary hypothermia is often caused by the underlying condition

**Diagnosis and Clinical Features:**

1. **Diagnostic Criteria:**
   a. History of cold exposure **OR** a predisposing disease/risk factor (*refer to Table 3) **AND**
   b. Exam: Cold torso **OR** core (internal) temperature less than 35°C (95°F)

2. Core temperature cannot be measured by EMS, so Table 1 should be used for clinical staging:

<table>
<thead>
<tr>
<th>Stage</th>
<th>Cold Torso + These Signs and Symptoms</th>
<th>Typical Core Temperature</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Conscious, shivering</td>
<td>35 to 32°C (95 to 90°F)</td>
</tr>
<tr>
<td>II</td>
<td>Impaired consciousness, not shivering</td>
<td>Less than 32 to 28°C (Less than 90 to 82°F)</td>
</tr>
<tr>
<td>III</td>
<td>Unconscious, not shivering, vital signs present</td>
<td>Less than 28 to 24°C (Less than 82 to 75°F)</td>
</tr>
<tr>
<td>IV</td>
<td>No vital signs, fixed and dilated pupils</td>
<td>Less than 24°C (Less than 75°F)</td>
</tr>
</tbody>
</table>


3. ECG and cardiac findings – Slow cardiac conduction, with a range of dysrhythmias, such as:
   a. Sinus bradycardia and AV nodal block: these generally resolve with rewarming
   b. Atrial fibrillation: common at core temperature less than 32°C (90°F)
   c. Osborn (J) waves: 80% of patients with core temperature less than 30°C (86°F)
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, SpO2 and ETCO2 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 SpO2 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
   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

**PATIENT'S TORSO FEELS COLD (or core temperature less than 95°F (35°C))**

**Vital Signs Present?**

**YES**

- **Impaired Level of Consciousness?**
  - **NO**
    - **Transport to nearest appropriate hospital,** unless Online Medical Control Physician authorizes non-transport
  - **YES**
    - **Systolic BP less than 90 mm Hg?**
      - **NO**
        - **Transport to Level I or Level II Trauma Center or other hospital with internal/invasive Rewarming Capabilities**
      - **YES**
        - **Transport to Level I or Level II Trauma Center or other hospital with internal/invasive Rewarming Capabilities**

**STAGE I**
- Provide warm, dry clothing and warm, dry environment
- Provide warm, sweet drinks or Oral 40% glucose gel
- Encourage active movement
- Contact BioTel as soon as possible

**STAGE II or III**
- Minimize movements
- Transport as soon as possible
- Prevent further heat loss
- Advanced airway management, as required
- Use active external rewarming techniques, if available
- Contact BioTel as soon as possible

**STAGE IV**
- Continue CPR and ACLS
- Contact BioTel as soon as possible

**Contact BioTel at ANY time with questions or concerns**

**NO to ALL**

**YES to ANY**

**Obvious signs of irreversible death?**
- OR
  - Valid OOH-GNR Order?
  - OR
    - Conditions unsafe for EMS Providers?

- **NO to ALL**
- **YES to ANY**

- **Start CPR**
- **Defibrillate once, if VF or pVT**
- **Transport as soon as possible**
- **Prevent further heat loss**
- **Advanced airway management**
- **Repeat defibrillation, if VF or pVT**
- Epinephrine 1:1,1000; 1 mg IV or IO every 5 minutes, up to 3 total doses

**Did cardiac arrest occur BEFORE hypothermia developed, due to Major trauma? OR Witnessed normothermic arrest?**

- **NO to ALL**
- **YES to ANY**

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

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

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†**

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