Accidental Hypothermia: Evaluation and Management

Guideline Introduction

Bibliography | Summary of Version Changes | Restrictions and Disclaimers

This guideline is intended to be used for **patients with accidental hypothermia** who meet the below inclusion criteria.

Inclusion Criteria for this Guideline: Meets definition for hypothermia;
mild: 90°F to 95°F (32°C to 35°C)
moderate:82.4°F to 90°F (28°C to 32°C)
severe: < 82.4 °F (28°C)

Exclusion Criteria for this Guideline: >35°C or history not consistent with prolonged/profound cold exposure OR immersion in ICY water. Consider excluding if HOPE score <10%

Key to using guideline

- *This is a guideline, not a policy. Patient variation and other factors may impact management decisions.*
- "Jump to" boxes contain hyperlinks to other pages of the guidelines. Clicking on the underlined word or phrase will take you to the page.
- Green boxes represent steps in an algorithm
- Yellow shapes represent decision branch points or key points of concern/caution
- Red stop sign means exit guideline as it no longer is appropriate for investigating and treating the patient's signs and symptoms.

- Multiple organ systems, including neurologic, metabolic, and cardiac, will stop functioning and ultimately lead to death. Cerebral blood flow continues to decline until patients become unresponsive. The most common presentation in severe hypothermia is unresponsiveness and arrhythmias.
- ***Core temperature monitoring (esophageal, bladder, or rectal) is required for management of hypothermia***

Hypothermia category	Description
Mild Hypothermia	• 90°F to 95°F (32°C to 35°C) • Symptoms: hypertension, shivering, tachycardia, tachypnea, vasoconstriction
Moderate Hypothermia	• 82.4°F to 90°F (28°C to 32°C) • Symptoms: Atrial dysrhythmias, j-waves on EKG, decreased heart rate, decreased level of consciousness, decreased respiratory rate , dilated pupils, shivering stops, muscle stiffness, loss of coordination, hyporeflexia, hypotension
Severe Hypothermia	• < 82.4 °F (28°C) • Symptoms: Ventricular arrythmias, asystole, apnea, coma, nonreactive pupils, muscle rigidity, rhabdomyolysis

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Rewarming Algorithm

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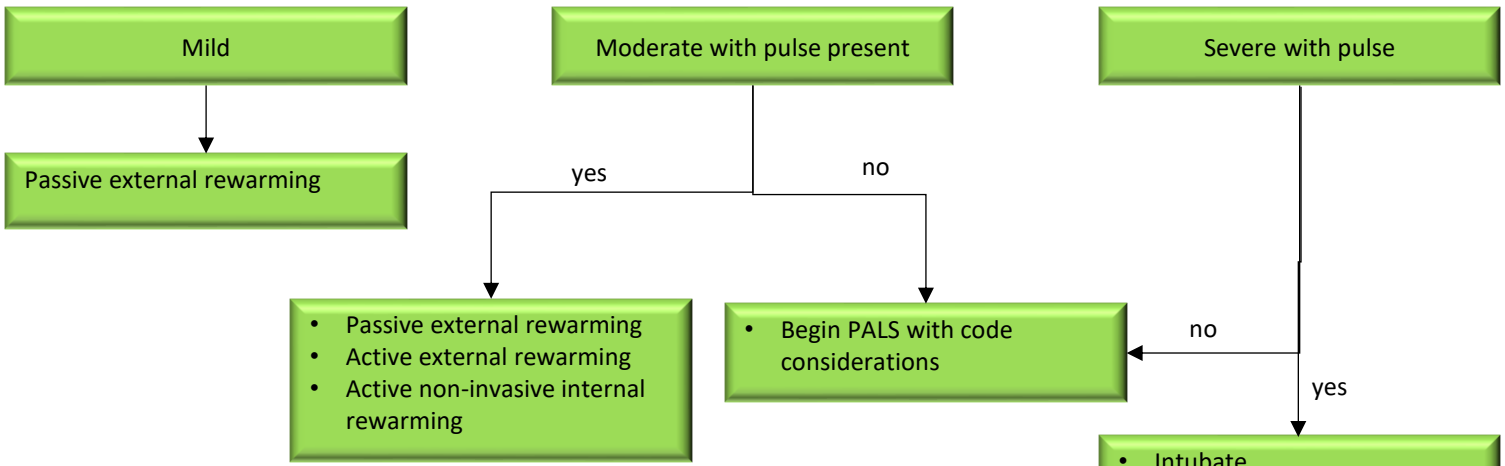
- Multiple organ systems, including neurologic, metabolic, and cardiac, will stop functioning and ultimately lead to death. Cerebral blood flow continues to decline until patients become unresponsive. The most common presentation in severe hypothermia is unresponsiveness and arrhythmias.
- Calculate HOPE score
- ***Core temperature monitoring (esophageal, bladder, or rectal) is required for management of hypothermia***



Initial Labs	If temperature remains <90F (32C)	Labs when> 90°F (32C) and until 96°F (35.3C)
CMP - POC blood glucose -ABL blood gas (to include blood gas, lactate, electrolytes, hemoglobin, ionized calcium) - CPK - PT - PTT - Fibrinogen - Urinalysis catheterized - CBC - Magnesium - Phosphorus	Q 2 hour: - ABG with lactate - Glucose - Electrolytes and ionized calcium - Magnesium - Phosphorus	•Q2h •ABG •Electrolytes •Lactate •Ionized calcium •Q4h •Magnesium •Phosphorus •Q8H •CBC •PT/INR, PTT

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Rewarming Techniques

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- Multiple organ systems, including neurologic, metabolic, and cardiac, will stop functioning and ultimately lead to death. Cerebral blood flow continues to decline until patients become unresponsive. The most common presentation in severe hypothermia is unresponsiveness and arrhythmias.
- ***Core temperature monitoring (esophageal, bladder, or rectal) is required for management of hypothermia***

Rewarming Techniques	Description
Passive external rewarming	• Remove wet clothes • Increase ambient room temperature • Standard or warmed blankets
Active external rewarming	• Warm air blanket
Active non-invasive rewarming	• Warmed humidified oxygen – non-invasive delivery • Warm IV fluids
Active invasive rewarming	• Body cavity lavage

Rewarming Interventions	Mild	Moderate with pulse	Moderate without pulse and Severe
Remove wet clothes			
Increase ambient room temperature			
Standard or warmed blankets			
Warmed humidified oxygen – non-invasive delivery			
Warm air blanket (BAIR Hugger)			
Warm IV fluids			
Body cavity lavage with warm fluids			
ECMO			

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Criteria for treatment of hypothermia with ECMO

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Accidental Hypothermia ECMO Criteria

Patient should meet all 5 criteria. If patient does not meet criteria 1 but meets criteria 2-5 AND has persistent/severe CV instability consult surgery and ICU to discuss ECMO activation

1. Core temp 82°Fahrenheit (28°Celsius) or lower
2. Arrest (asystole or VF/VT) or profound bradycardia with hypotension
3. History consistent with prolonged/profound cold exposure OR immersion in ICY water (December-February or frozen water source)
4. No obvious injuries incompatible with survival
5. Potassium Level <12

ECMO Management and Considerations post Cannulation

Consider VA ECMO Only

1. Flow rate: initial goal 100 mL/kg and monitor down trending lactate, NIRS, gas and signs of adequate oxygen delivery for goal flow rate titration.
2. Prime Blood Temperature: turn on ECMO warmer and warm blood before going on
3. Rewarming Rate:
    1. Goal maximum speed of 4°C/h
    2. Maintain a temperature gradient between patient and EMCO of < 4°C and a maximum of 10°C
    3. Measure body temperature at more than one site simultaneously
    4. Have volume ready for resuscitation as patient temperature increases
4. Arrhythmias: once you achieve normothermia (95-96.8F/35-36C), treat arrhythmias per PALS algorithm. Do not treat arrhythmias while patient is on ECMO until normothermia is achieved
5. Hyperkalemia: If K rises after going on ECMO, treat according to hyperkalemia management guideline
6. FiO2: start with 100% since during rewarming massive endothelial damage and lung edema may occur. Once 96F reached, wean FiO2 according to PaO2 to avoid the risk of hyperoxia and additional alveolar damage
7. Anticoagulation: check coags prior to cannulation if possible and if patient coagulopathic, consider running heparinless for 24 hours or until coagulopathy improves.

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Code Management Considerations

- Once the hypothermic patient enters cardiac arrest, successful resuscitation can potentially take hours. Despite the long resuscitation time, severely hypothermic patients can recover neurologically intact. Thus, providers should focus on rewarming the patient (rewarming techniques and ECMO) and providing adequate cardiac support until the patient is completely rewarmed
- Follow ACLS/PALS guidelines for CPR, drug choice and algorithm

Rhythm	Recommendations
Sinus Bradycardia	• Obtain Electrolytes and treat accordingly • Consider External Pacing once normothermia is achieved • AVOID CPR if pulse is present . • *This is considered a stable arrhythmia in the setting of hypothermia and CPR can precipitate malignant arrhythmias
Ventricular Tachycardia without a pulse /Ventricular Fibrillation	• Delay vasopressor administration until core temperature > 86°F (30°C) • The dosing interval of medications should be doubled when the patient's temperature is 86- 94.8°F (30–34.9°C) • Defibrillation x2 attempts and then continue rewarming and delay further defibrillation attempts until > 86°F (30°C)
Asystole	• Delay vasopressor administration until core temperature > 86°F (30°C) • The dosing interval of medications be doubled when the patient's temperature is 86-94.8°F (30–34.9°C)

Additional Code Considerations

- Do not use ETCO2 as a guide for quality of CPR as metabolic rate is so low
- Avoid succinylcholine and lactated ringers for worsening hyperkalemia risk
- Blood samples for decision making (i.e. potassium) should be from an ultrasound guided puncture or open puncture of the femoral vessels
- Treat elevated K with hyperkalemia management guideline
- Check glucose and treat if low with hypoglycemia management guideline
- During the rewarming process, hypothermic patients suffer refractory hypotension due to vasoplegia and fluid shift. Because of these complications, patients may deteriorate briefly before they begin to improve. Be prepared for vasopressor need and fluid resuscitation to maintain age appropriate MAP for cerebral perfusion.
- "Rewarming acidosis" may occur as pooled lactic acid from the periphery joins the central circulation

HOPE Scoring Tool

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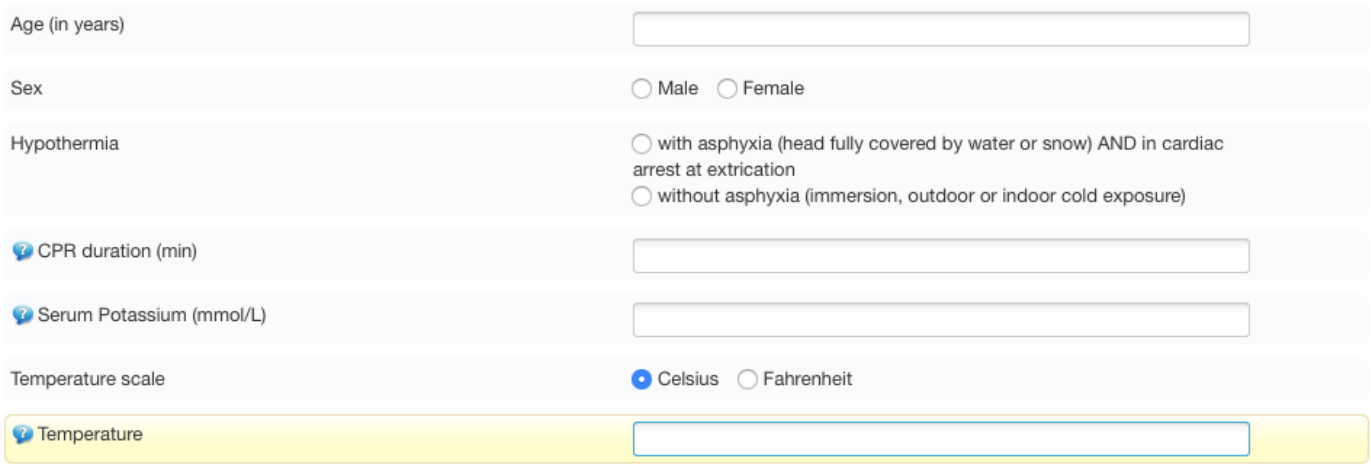
HOPE Scoring Tool: rewarming is recommended with HOPE survival probabilities of ≥10%

https://www.hypothermiascore.org



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Version History

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Version	Date	Guideline Owner	Summary of Edits	Next Revision Due
1	12/2022	Dr. Jaime Furlong-Dillard	Not applicable - New	10/2023
2	6/2025	Dr. Jaime Furlong-Dillard	1. Additional references added 2. No change to content	6/2029

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Disclaimers and Restriction

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