Management of Winter Emergencies

McHenry Western Lake County EMS Office
Thermoregulation

Homeostasis requires stable temperature
~98.6°F
Thermoregulation

• Control mechanism
  - Hypothalamus
  - Peripheral thermoreceptors
• Balance between heat production, heat loss
Heat Production

- Metabolism
- Voluntary large muscle movement
- Shivering
Heat Loss

- Conduction
- Convection
- Radiation
- Evaporation
  - Skin
  - Respiratory tract
Heat Production > Heat Loss causes

Increased Body Temperature
Heat Loss > Heat Production causes Decreased Body Temperature
Heat and Cold Induced Illness

• Results from:
  - Increase or decrease in body temperature outside normal range
  - Prolonged efforts to compensate
Cold-Related Illness

- Local cold injury
- Generalized cooling
Local Cold Injury

• Nonfreezing
  - Chilblains
  - Trench foot

• Freezing
  - Frostnip
  - Frostbite
Chilblains

- Caused by chronic exposure to damp, nonfreezing ambient temperatures
- Painful, inflammatory lesions on skin
- Hands, ears, lower legs, feet common sites
- Pruritus, burning, paresthesias
- Tends to recur
- Rewarm, bandage, elevate
Trench Foot

• Caused by prolonged skin exposure to cool, wet conditions
• Skin becomes pale, mottled, anesthetic
• Sloughing, gangrene may occur
• Clean, warm, dry bandages; elevation
Frostnip/Frostbite

- Local freezing of tissue
- Commonly affected areas:
  - Toes, feet
  - Hands, fingers
  - Nose
  - Ears
Frostnip/Frostbite

• Risk Factors
  - Poor clothing
  - Poor nutrition
  - Diabetes
  - Decreased tissue perfusion
    • Tobacco, tight clothing
  - Vasodilation
    • EtOH, medications
Frostnip/Frostbite

• Pathophysiology: Phase I
  - Exposure to cold
  - Vasoconstriction
  - Decreased blood flow to periphery
  - Ice crystal formation in extracellular space, ischemia
  - Cellular dehydration, hyperosmolarity
Frostnip/Frostbite

- Pathophysiology: Phase I
  - Edema
  - Increased pressure, blood vessel damage
  - Worsened ischemia
  - Destruction of cellular components
Frostnip/Frostbite

• Pathophysiology: Phase II
  - Tissue is rewarmed
  - Blood flow returns
  - Damaged capillaries leak fluid
  - Swelling occurs
  - Sludging of blood, thrombus formation occurs
Frostnip

• Extremity appears pale, discomfort present
• No extracellular ice crystal formation
• Symptoms resolve on rewarming
• Tissue loss does not occur
Frostbite

Extent of injury frequently cannot be determined until rewarming occurs
Frostbite

• Signs/Symptoms
  - 1st degree
    • Partial skin freezing; redness, mild edema; lack of blisters
  - 2nd degree
    • Full thickness freezing; substantial edema, formation of clear blisters
Frostbite

• Signs/Symptoms
  - 3rd degree
    • Full-thickness skin and subcutaneous freezing; hemorrhagic blisters, skin necrosis, bluish-gray discoloration
  - 4th degree
    • Full-thickness damage affecting muscles, tendons, bones; little edema, initially mottled or cyanotic, eventually dry, black, mummified
Frostbite
Frostbite
Frostbite

• Management: Short transport
  - ABCs
  - Protect affected area
    • Bandage
    • Avoid rewarming, thawing
  - Prevent, treat hypothermia
    • Remove wet or constrictive clothing
    • Dry patient
    • Warm IV fluids
  - Minimal analgesics (NSAIDS) for pain
Frostbite

- Management: Long transport
  - Remove patient from cold
  - Remove clothing from affected area
  - Rewarm in water 90°F - 105°F if available
  - Dry gently, bandage
  - Treat concurrent hypothermia
  - Anticipate severe pain when rewarming: Nitrous Oxide, Fentanyl or Ketamine per pain protocol.
Frostbite

• Do NOT:
  - Allow refreezing
  - Massage injured part
  - Allow patient to smoke
  - Puncture or drain blebs
Hypothermia

• Core Temp < 95 ºF
• May be caused by:
  - Decreased heat production
  - Excess heat loss
• Various associated factors
  - Environment (temperature, wet vs. dry)
  - Energy (food, water)
  - Ambulatory ability
Hypothermia

- Risk factors
  - Extremes of age
  - Those outdoors
  - Hypothyroidism
  - Diabetes, hypoglycemia
  - Alcohol, depressant drug abuse
  - Poor nutrition
Hypothermia

- Pathophysiology
  - Immediate vasoconstriction
  - Catecholamine release
  - Increased HR, RR, BP
  - Shivering until
    - glucose depleted
    - temperature below 90°F
  - Shivering stops ⇒ rapid cooling
- Eventual ↓ in RR, HR, BP
- Cardiac Arrest < 86 °F
Hypothermia

- Pathophysiology
  - Left shift of oxyhemoglobin dissociation curve
  - Decreased oxygen release to tissues
  - Depression of insulin release, effectiveness
  - Hyperglycemia
  - Depression of ADH release
  - Increased urine output, “cold diuresis”
Hypothermia

• Signs/Symptoms
  - Pallor, shivering
  - Ataxic gait
  - Apathy, drowsiness, coma
  - Slowing pulse rate, respirations
  - Cardiac arrest
  - Altered LOC + Cool Environment = ? Hypothermia
Hypothermia

Altered LOC + Cool Environment = ?
Hypothermia
Hypothermia

- ECG changes (mostly late)
  - Bradycardia (possibly unresponsive to atropine)
  - Small, absent P wave
  - Abnormal ST segments, T waves
  - J (Osborn) wave
Hypothermia

- J waves
Hypothermia- Frostbite

- **ITC:** Move to a warm environment as soon as possible. Remove wet/constrictive clothing/jewelry.
- Rapidly rewarm frozen areas. Do **NOT** thaw if chance of refreezing.
- Immerse in warm water (90°F-105°F) if available
- May use hands/hot packs wrapped in a towel. Use warming mattress if available.
- HANDLE SKIN GENTLY like a burn. Do **NOT** rub. Do not break blisters.
- Protect with light, dry, sterile dressings; cover with warm blankets and prevent re-exposure
- Anticipate severe pain when rewarming: *Nitrous Oxide, FENTANYL or KETAMINE*: standard dose per **PAIN Protocol**
Pain Protocol

**Goal:** Pain is reduced by at least 2 points on the pain scale and/or to tolerable levels (may not reach a rating of 0) unless pain interventions are contraindicated, the patient has AMS (GCS <15 or mentation <baseline), is hypotensive for age/condition, or refuses the intervention.

**VERIFY DOsing:** 7 R’s of medication administration; independent cross-check

**OPTIONS:** Pharmacologic and non-pharmacologic

- **BLS:** Splinting, distraction, imagery, cold packs.
- **BLS:** Mild-moderate pain - ≥13 years: ACETAMINOPHEN (Tylenol) 650 mg PO if available
- **ALS:** NITROUS OXIDE if available - Patient must be able to self-administer to effect

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If severe pain (7-10): Opiate naive

**FENTANYL:** 1 mcg/kg (max single dose 100 mcg) IVP/IN/IM/IO.
May repeat once in 5 min: 0.5 mcg/kg (max dose 50 mcg).
Max total dose per SOP: 150 mcg (1.5 mcg/kg)
Elderly (≥ 65) / debilitated: 0.5 mcg/kg (max single dose 50 mcg) IVP/IN/IM/IO.
Additional doses require OLMC: 0.5 mcg/kg q. 5 min up to a total of 3 mcg/kg (300 mcg) if indicated & available

Severe pain: Opiate tolerant or dependent or allergy to fentanyl or option if pt. needs mild sedation + pain relief:

**KETAMINE:** 0.3mg/kg slow IVP (over 1 min) or IN/IM. May repeat X 1 in 20 minutes.
See dosing chart in appendix (pg. 95)

Assess and document response to interventions: Reassess pain, VS, SpO₂ and ETCO₂, GCS, within 5 min after each dose of an opiate or ketamine. If no improvement, adjust regimen or consider need for repeat dosing.
Hypothermia

• Management
  - Mild = core temperature 90.6°-95°F
  - Moderate = core temperature 82.4°-90.6°F
  - Severe = core temperature <82.4°F
Hypothermia - Initial Care

- Management:
  - Prevent further heat loss & begin rewarming immediately: place in warm environment, remove wet clothing; dry patient; insulate from further environmental exposures
  - Position supine; handle gently when checking responsiveness, breathing and pulse
  - Assess breathing and pulse for 30-45 sec. Pulse & RR may be slow and difficult to detect
  - IV NS. Warm IVF up to 43° C (109° F); coil tubing if possible; do not infuse cold fluids
  - Monitor ECG & GCS continuously; may observe Osborn or J wave in leads II and V6
  - Obtain core temperature if possible; assess for frostnip, frostbite
  - Minimize movement to ↓ myocardial demand; prevent translocation of cold blood from periphery to the core and ↓ severe muscle cramping
Hypothermia - Mild/Moderate

- Management: (lower acuity to emergent)
- **Mild**: Core temp 90.6-95°F (32-35°C): Confusion, tachycardia, shivering
- **Moderate**: Core temp 82.4-90.6°F (28-32°C): Lethargy, bradycardia, arrhythmias, shivering ceases <31°C (87.8°F); slowed speech/ataxia (mimics stroke), muscle rigidity, slow RR, CO₂ retention, pupils dilated & minimally responsive
- **Passive rewarming** generally adequate for pts w/ T > 93.2°F: Cover with blankets; protect head from heat loss.
- **Active external rewarming** (T 82°- 93.2°F): Continue passive + apply surface warming devices (wrapped hot packs to axillae, groin, neck, & thorax; warming mattress if available). Passive rewarming alone inadequate for these pts.
- Warm NS IVF challenges in 200 mL increments (Ped: 10 mL/kg) to maintain hemodynamic stability
Hypothermia Protocol – Severe (Critical)

- Core temp <28°C (82.4°F), coma, muscle rigidity, cardiac dysrhythmias: bradycardia, VF (cardiac arrest/absent pulse); hypotension, slowed RR to apnea, pupils fixed & dilated, no shivering

  - ITC special considerations:
  - Core rewarming (not generally available in field). Rewarm trunk only with hot packs; avoid rewarming extremities
  - **Consider need for advanced airway:** If indicated; use gentle technique to prevent vagal stimulus and VF
  - \(O_2\) 12-15 L/NRM or BVM (warm to 42°C / 107.6°F if possible); do **NOT** hyperventilate - chest will be stiff
  - **Vascular access:** Warm NS 200 mL (peds 10 mL/kg) IVP/IO fluid challenges up to 1 L
  - Will require large volume replacement due to leaky capillaries, fluid shift, and vasodilation as rewarming occurs
Hypothermia Protocol –Severe (Critical)

- If unresponsive with no breathing or no normal breathing (only gasping) check for a pulse.
  - Pulse not definitely felt in **30** seconds: Start CPR - **TRIPLE ZERO CANNOT BE CONFIRMED** in these patients
  - Treat per CARDIAC ARREST SOP concurrent with rewarming;

- **ROSC**: Support CV status per CARDIAC ARREST SOP; look for & treat causes of severe hypothermia
  - If induced hypothermia indicated: Continue to warm to goal temp of 34° C / 93.2° F
  - If hypothermia contraindicated (trauma patient); continue rewarming to normal temp
  - Transport very gently to avoid precipitating VF
Hypothermia

• Hypothermic Cardiac Arrest
  - Resuscitate aggressively
  - Little consideration given to terminating resuscitation efforts

You’re not dead until you’re warm and dead
Hypothermia Protocol

Environmental: COLD Emergencies (adult & peds)

FROSTBITE
1. ITC: Move to a warm environment as soon as possible. Remove wet/conductive clothing/immedi
   • Immune in warm water (90°-105°F) if available
   • May use handuls of water wrapped in a towel. Use warming mattress if available
   • HANDLE SKIN GENTLY like a burn. Do NOT rub. Do not break blisters
   • Protect with light, dry, sterile dressings; cover with warm blankets and prevent re-exposure
2. Rapidly rewarm frozen areas. Do NOT thaw if chance of refreezing.
   • Immerse in warm water (90°-105°F) if available
   • May use handuls of water wrapped in a towel. Use warming mattress if available
3. Anticipate severe pain when rewarming: Nitric Oxide, PEN-TANYL or KETAMINE: standard dose per PAIN (pg 0)

HYPOTHERMIA
Risk factors: Exposure, extremes of age, cold IVF, burns, head/SCI injuries, shock, co-morbidities, drugs & alcohol use, impaired homorregulation, stroke, malnutrition, endocrine failure, vascular compromise

1. ITC special considerations:
   • Prevent further heat loss & begin rewarming immediately: place in warm environment, remove wet clothing, dry patients; isolate from further environmental exposure
   • Position supine, handle gently when checking responsiveness, breathing and pulse
   • Assist breathing and pulse for 30-45 sec. Pulse & RR may be slow and difficult to detect
   • IV NS. Warm IVF up to 43° C (109°F). Core tubing if possible. Do not infuse cold fluids
   • Monitor ECG & O2S continuously, may observe Q waves or J wave in leads II and V6
   • Obtain core temperature if possible, assess for hypothermia, measure
   • Minimize movement to ↓ myocellular demand: prevent transfusion of cold blood from periphery to the core and ↓ severe muscle cramping

MILD/MODERATE Hypothermia (Lower acuity to EMERGENT)
Mild: Core temp 90-95°F (32-35°C): Confusional, bradycardia, shivering
Moderate: Core temp 85-90°F (30-32°C): lethargy, bradycardia, arrhythmias, shaking (shivering <3°C (87.8°F)), slowed speech/volca (mimics stroke), muscle rigidity, slow RR, CO2 retention, pupils dilated & minimally responsive

2. Passive rewarming generally adequate for pts at T > 93°F: Cover with blankets, protect head from heat loss
   • Active external rewarming (T 62°-92.2°): Continue passive + apply surface warming devices (wrapped hot packs to axil, groin, neck & thorax; warming mattress if available). Passive rewarming alone inadequate for these pts
   • Warm IVF intravenous in 200 mL increments (Ped: 10 mL/kg) to maintain hemodynamic stability

SEVERE Hypothermia [CRITICAL]: Core temp <90°F (32.4°F), coma, muscle rigidity, cardiac dysrhythmias, bradycardia, VF (pallid, armless, personable pulse), hypothermia, slowed RR to apnea, pupils fixed & dilated, no shivering

2. ITC special considerations:
   • Core rewarming (not generally available in field). Rewarm trunk only with hot packs; avoid rewarming extremities
   • Generalist need for advanced airway if indicated; use gentle technique to prevent vocal stigm and VF
   • G2 12-15 L/min or BVM (warm to 42°C / 107.6°F if possible). Do not hyperventilate: chest will be stiff
   • Vascular access: Warm NS 200 mL (ped: 10 mL/kg) IV fluid challenges up to 1 L
   • Will require large volume replacement due to leaky capillaries, fluid shift, and vasodilation as rewarming occurs
   • If unconscious or no breathing or no normal breathing (only gasping) check for a pulse
   • Pulse not definitely felt in 30 seconds: Start CPR - TRIPLE ZERO CANNOT BE CONFIRMED in those patients
   • Treat per CARDIAC ARREST SOP concurrent with rewarming

ROSC: Support CV status per CARDIAC ARREST SOP: look for & treat causes of severe hypothermia
   • If hypothermia indicated: Continue to warm to core temp of 94° C / 93.2°F
   • If hypothermia contraindicated (trauma patient): continue rewarming to normal temp

Transport very gently to avoid precipitating VF
Cold Emergencies

Mild: Core temp 90.6-95° F (32-35° C): Confusion, tachycardia, shivering

Moderate: Core temp 82.4-90.6° F (28-32° C): Lethargy, bradycardia, arrhythmias, shivering ceases <31°C (87.8°F); heat production falls, slowed speech/ataxia (mimics stroke) replaced by muscle rigidity, slowed reflexes, slow RR, CO2 retention, pupils dilated & minimally responsive

Passive rewarming generally adequate for pts w/ T > 93.2° F: Cover with blankets; protect head from heat loss.

Active external rewarming (T 82°- 93.2° F): Continue passive + apply surface warming devices (wrapped hot packs to axillae, groin, neck, & thorax; warming mattress if available). Passive rewarming alone inadequate for these pts.

Warm NS IVF challenges in 200 mL increments to maintain hemodynamic stability

Frostbite

Hypothermia

Severe Hypothermia

ITC:

Move to a warm environment as soon as possible. Remove wet/constrictive clothing/jewelry. Rapidly rewarm frozen areas. Do NOT thaw if chance of refreezing. Immerses in warm water (90°-105°F) if available. May use makeshift pads wrapped in a towel. Use warming mattress if available. HANDLE SKIN GENTLY like a burn. DO NOT rub. Do not break blisters. Protect with light, dry, sterile dressings; cover with warm blankets and prevent re-exposure. Anticipate severe pain when rewarming. Nitrous Oxide, Fentanyl or Ketamine per pain SOP

ITC

Prevent further heat loss & begin rewarming immediately; place in warm environment, remove wet clothing; dry patient; insulate from further environmental exposures.

Position supine; handle gently when checking responsiveness, breathing and pulse. Assess breathing and pulse for 30-45 sec. Pulse & RR may be slow and difficult to detect.

If NS: Warm IVF up to 43°C (110°F); coil tubing if possible; do not infuse cold fluids. Monitor ECG & GCS continuously; may observe Osborn or J wave in leads II and V6.

Obtain core temperature if possible; assess for local thermal injury (frostnip, frostbite).

Minimize movement to decrease myocardial demand; prevent translocation of cold blood from periphery to the core and decrease severe muscle cramping.

Mild: Core temp 90.6-95° F (32-35° C): Confusion, tachycardia, shivering

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Passive rewarming generally adequate for pts w/ T > 93.2° F: Cover with blankets; protect head from heat loss.

Active external rewarming (T 82°- 93.2° F): Continue passive + apply surface warming devices (wrapped hot packs to axillae, groin, neck, & thorax; warming mattress if available). Passive rewarming alone inadequate for these pts.

Warm NS IVF challenges in 200 mL increments to maintain hemodynamic stability

Severe Hypothermia

(Core temp < 28 C or 82.4 F)

Core rewarming (not generally available in field). Rewarm trunk only with hot packs; avoid rewarming extremities.

Consider need for advanced airway: use gentle technique to prevent vagal stimulus and VF.

O2 12-15 L/NRM or BVM (warm to 42°C / 107.6° F if possible); do NOT hyperventilate - chest will be stiff.

Vascular access: Warm NS 200 mL, IVPKO fluid challenges up to 1 L.

Will require large volume replacement due to leaky capillaries, fluid shift, and vasodilation as rewarming occurs.

If unresponsive with no breathing or no normal breathing (only gasping) check for a pulse. Pulse is not definitely felt in 30 seconds: Start CPR - TRIPLE ZERO CANNOT BE CONFIRMED on these patients.

Treat patient per Cardiac Arrest SOP. Support CV status per Cardiac Arrest SOP; look for & treat causes of severe hypothermia.

If induced hypothermia indicated: Continue to warm to goal temp of 34°C / 93.2°F.

If hypothermia contraindicated (trauma patient); continue rewarming to normal temp, Transport very gently to avoid precipitating VF.

If induced hypothermia indicated: Continue to warm to goal temp of 34°C / 93.2°F.

If hypothermia contraindicated (trauma patient); continue rewarming to normal temp, Transport very gently to avoid precipitating VF.
Thank You!
Please do the quiz and send to the EMS Office per the instructions when completed.

Special thanks to Temple College for the permission to use their materials in this presentation.