Foundations Frameworks

Approach to Hypothermic Resuscitation

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1. **Suspicion of Hypothermia: Rapid Assessment**
    a. Obtain rectal core body temperature immediately
        i. Temperature ≤ 32°C → enter pathway

2. **Cold + Alive: Vital Signs Present**
    a. **Stable(ish) Hypothermia**
        i. **"Conservative Treatment" → stable patient, unlikely to need ECMO**
        ii. Features include:
            1. Temp > 28°C
            2. Stable cardiac features (low likelihood to degenerate into malignant arrhythmia or cardiac arrest)
                a. NSR, bradycardia, atrial fibrillation
                b. Normotensive
        iii. Treatment: these patients need rewarming:
            1. Passive External Rewarming: move to warm environment, remove cold/wet clothing, apply warm blankets
            2. Active External Rewarming: forced-air warming systems (e.g. Bair Hugger), heat packs, warm water bath
            3. Active Internal Rewarming: warm IV fluids, bladder lavage, airway rewarming via heated ETT inspired air, gastric lavage, thoracic/peritoneal lavage

    b. **Unstable Hypothermia**
        i. **"Aggressive Treatment" → unstable patient, consider transfer to ECMO center after initial resuscitation**
        ii. These patients are highly unstable and may degenerate into cardiac arrest → recommended that these patients receive care at an ECMO facility (consider transfer if not at an ECMO facility)
        iii. Features include:
            1. Temp ≤ 28°C
            2. Unstable cardiac features (high likelihood to degenerate into cardiac arrest)
                a. Ventricular ectopy/arrhythmias
                b. Severe hypotension
        iv. Treatment:
            1. Airway management, warm fluid resuscitation, vasopressors
            2. Active external/internal rewarming
            3. Limit movement: to avoid inducing an arrhythmia
            4. Strongly consider transfer to ECMO center

3. Cold + Dead: No Vitals Present

- **a. Salvageable**
  - i. These patients have a chance at neurologic recovery
  - ii. Situation in which hypothermia causes the arrest
  - iii. These patients need ECMO, consider transfer to ECMO center if within 6 hours of arrest with "good story" for hypothermic arrest
  - iv. Even if you get ROSC, they will likely still need ECMO services (ARDS)
  - v. Treatment:
    1. Start high quality chest compressions
    2. Initiate ECMO if available
    3. Active external/internal rewarming
    4. Shocks/Epi?
       - a. Mixed data
       - b. European Resuscitation Council Guidelines: up to 3 defibrillations until > 30°C, withhold epi until core temp > 30°C (already highly vasoconstricted), 30-35°C: give epi every 6 minutes (instead of every 3 minutes)
       - c. American Heart Association Guidelines: states that it is reasonable to consider administration of a vasopressor and shocks in usual ACLS algorithm
  - vi. If ECMO not available, arrange transport to ECMO center. Continue CPR and rewarming. In hypothermic arrest patients who receive ECMO or bypass, survival can reach up to 50%
  - vii. Patient Not Dead Until Warm and Dead
    1. Withdraw care if patient temp > 32°C and still no pulse

- **b. Unsalvageable**
  - i. These patients are cold but unsalvageable and will not benefit from continued resuscitation
    1. Chest wall frozen solid + not compressible
    2. Potassium Level > 12 mmol/L
       - a. Severely elevated potassium is associated with non-survival and is a marker of hypoxia before patient became hypothermic
    3. Hypothermia not cause of arrest: patient died before cooling took place, likely not a true hypothermic arrest
       - a. Cardiac arrest, traumatic arrest, etc.
       - b. Example: Immersion vs. Submersion
         - i. Immersion: Patient immersed in cold water but able to breath, suffers hypothermia arrest before onset of hypoxia and cardiac arrest → survival with neurologic impairment possible
         - ii. Submersion: Patient with submersion in cold water and suffers hypoxia induced arrest prior to cooling → unlikely to have significant neurologic recovery

References:

- Silfvast T, Pettilä V. Outcome from severe accidental hypothermia in Southern Finland — a 10-year review. Resuscitation 2003;59:285-90.
- Baumgartner EA, Belson M, Rubin C, Patel M. Hypothermia and other cold-re- lated morbidity emergency department visits: United States, 1995-2004. Wilder- ness Environ Med 2008;19:233-7.
- Brown, DJ; Brugger, H; Boyd, J; Paal, P (Nov 15, 2012). "Accidental hypothermia.". *The New England Journal of Medicine*. 367 (20): 1930–8.
- Danzl DF, Pozos RS. Accidental hypo- thermia. N Engl J Med 1994;331:1756-60.
- Danzl DF, Pozos RS, Auerbach PS, et al. Multicenter hypothermia survey. Ann Emerg Med 1987;16:1042-55.v