SDC Figure 1: Trauma Center Guidelines for Use of Hypothermia Following Adult Cardiac Arrest

Inclusion Criteria
- Sustained cardiac arrest related to ventricular tachycardia, ventricular fibrillation, pulseless electrical activity or asystole
- Restoration of circulation within a reasonable time that there is a chance for sustainable recovery in the judgment of the attending physician
- Glasgow Coma Scale score < 8 (determined after return of spontaneous circulation)
- Hemodynamically stable (e.g., systolic BP ≥ 85 mmHg or MAP ≥ 55 mmHg) with or without vasoactive agents or circulatory support
- Must have a protected airway and be on mechanical ventilatory support

Exclusion Criteria
- Existing advanced directives precluding resuscitation or hypothermia
- Hemodynamically unstable (see above)
- Pre-arrest significant neurologic injury or GCS score pre-arrest < 5; Relative contraindications include: coagulopathy, active bleeding, sepsis

Hypothermia Management
- Prior to cooling obtain the following studies: Arterial blood gases, complete blood count, chemistry panel, lactate level, cardiac enzymes, coagulation parameters, amylase, lipase, liver function tests, chest radiograph, electrocardiogram
- Insert a continuous temperature monitor (Bladder, esophageal [do not use esophageal if performing gastric lavage], pulmonary artery catheter or rectal probe)
- Use an heat moisture exchanger (HME) for patient humidification
- Administer a sedatives, analgesia and neuromuscular blockade:
  - Sedation:
    - Midazolam (Versed®) 0.125mg/kg/hr IV continuous infusion and titrate to RASS -4 (deep sedation)
    - OR:
    - Propofol (Diprivan®): initially at 5 mcg/kg/min; titrate every 5 minutes until at goal; maximum rate 75 mcg/kg/min continuous infusion; titrate to RASS -4 (deep sedation)
  - Analgesia:
    - Fentanyl (Sublimaze®): 50-100 mcg IV bolus x 1, then fentanyl (Sublimaze®) initially at 50 mcg/hr continuous infusion
  - Neuromuscular Blockade:
    - Before starting neuromuscular blocking agent (NMBA), verify that the patient is adequately medicated with analgesic and sedative agents at goal and is receiving mechanical ventilation.
    - Obtain baseline “train of four” (TOF), then every hour. Adjust degree of NMBA to achieve 1-2 twitches of 4. If unable to obtain TOF, titrate NMBA to prevent shivering.
    - If patient has significant renal or hepatic dysfunction, consider:
    - Cisatracurium (Nimbex®): 0.15-0.2 mg/kg IV bolus x 1, then Cisatracurium (Nimbex®) (100mg in 100 ml D5W): 1-2 mcg/kg/min continuous infusion
- Lower patient’s body temperature to 32 (89.6 degrees F) – 34 (93.2 degrees F) degrees C as quickly as possible (preferably within 30 minutes of arrest but taking no longer than 1 hour) using the following methods as needed in the order listed:
1. Intravenous administration of 2 liters of iced cold fluid. (2 liters of saline for IV use will be stored in the refrigerators in the satellite pharmacies throughout UMMC.) Proceed to other techniques if patient volume overloaded and additional fluid administration is contraindicated.

2. Surface cooling techniques (a number of these techniques may be used in tandem with other strategies to cool the patient)
   - Bair Hugger
   - Cooling blankets (Set at 33 degrees C [91.4 degrees F])
   - Ice packs around the head, axilla and femoral areas

3. Iced saline lavage via a gastric tube – This is done by inserting a Salem sump and infusing continuous iced saline through the blue port while applying low intermittent suction to the suction port. Iced saline should be infused through the blue port at a rate of 200 – 300 cc/hour.

4. Invasive Cooling measures
   - Endovascular cooling device
   - Continuous renal replace therapy

   - Maintain hypothermia for 24 hours
   - During and for at least 24 hours after hypothermia vital signs should be monitored continuously and recorded at least every 1 hour
   - An arterial line and central venous catheter should be placed during induction; A continuous SvO₂ or ScvO₂ monitor may be desirable. Significant decreases in SvO₂ may occur with hypothermia especially if neuromuscular blockade is inadequate.
   - Maintain normocarbia (use ETCO₂ to monitor CO₂ level)
   - Continuously monitor SpO₂
   - Maintain mean arterial blood pressure > 65 mmHg
   - Every 6 hours obtain the following laboratory studies during therapeutic hypothermia and for 24 hours after rewarming begins: arterial blood gases (temperature corrected), mixed venous or central venous blood gas for venous oxygen saturation unless continuous SvO₂ or ScvO₂ monitoring is being utilized, complete blood count, chemistry panel, lactate level, cardiac enzymes, coagulation parameters
   - Passive Rewarming
     - At 24 hours after the initiation of cooling, remove all cooling measures.
     - The literature recommends that the body be re-warmed no faster than 0.5 – 1 degree C (1 – 2 degrees F) every hour. It will take about 8 hours to passively re-warm.
     - Maintain paralytic and sedation until temperature of 36 degrees C or 96.8 degrees F is reached. First discontinue the paralytics and then the sedation after a train of four of 4 is achieved. If the patient’s neurologic assessment remains a concern due to paralysis, consider administering a reversal agent.
     - Monitor patient for hypotension related to vasodilation associated with rewarming Hypothermia induces vasoconstriction that when rewarming occurs may result in a functional hypovolemia that may require fluid administration.
     - Monitor patient for hypokalemia
     - The goal is to achieve normothermia and to avoid hyperthermia.
   - Consider obtaining a neurology consult if the patient’s neurologic condition remains a concern.