Goals:
The aim of this therapy is to suppress the chemical reactions that occur when vital signs have been absent and reperfusion has occurred after cardiac arrest. To initiate current evidence based research and best practice guidelines to the caregiver, which has been shown to improve patient neurologic outcomes post cardiac arrest, where resuscitation has been delayed or prolonged. Induction of mild hypothermia post cardiac arrest will slow bodily processes thereby decreasing the effects of hypoxia after the cardiac event.

Zoll / Alsius Cooling Catheter:
The cool catheter should be placed in the femoral vein and functions as a closed loop interval cooling circuit, which cools the blood as it circulates past the catheter. The catheter is attached to the Zoll/Alsius thermal regulation system, which monitors catheter performance and measures temperature via a connection to the internal thermometer probe. The machine should ideally be plugged in 20 minutes prior to use and set to maximal cooling with a target temperature of 33°C for 24 hrs.

Equipment:
1) CVP/PA or Esophageal, and bladder catheter temperature probe
2) Two cooling blanket devices
3) Two liters of 4°C .09% Saline
4) Cooling Catheter

Inclusion criteria:
- Hypothermia should be initiated within 3 hrs of return of spontaneous circulation (ROSC)
- Hypothermia can be initiated up to 12 hrs of ROSC
- Must include the following:
  o Cardiac arrest does not need to be witnessed
  o Patient had pulseless VT, VF, PEA, or Asystole at some time during this cardiac event
  o Significant altered level of consciousness (example but not limited to:)
    ▪ Not following commands
    ▪ No purposeful movements
    ▪ No purposeful response to pain
    ▪ No comprehensible speech

Exclusion Criteria:
- Patient is under18 years of age
- History of Bleeding disorder or current coagulopathy (Coumadin, Lovenox, Aspirin, etc.. are not contraindications)
- Active Bleeding
- Currently Pregnant
- Evidence of Trauma – ie: Trauma as possible cause of cardiac arrest
- Environmental hypothermia exposure (hypothermia as possible cause of arrest)
- Presence of other etiology for coma (ie.. Drug Overdose, Head Trauma, Hemorrhagic Stroke, Status Epilepticus, Infection, etc..)
- Known major surgery within two weeks
- Cardiac instability
  o Refractory or recurrent life threatening dysrhythmia
  o Hypotension is not an absolute contraindication.
Pre-induction phase:
- Start 2 IVs each 20 ga or larger
- Continuous ECG monitoring
- Continuous $\text{SpO}_2$ monitoring
- Insert Temp Probe Foley Catheter
- Urine HCG on females of child bearing age
- Order ABG, CBC, BMP, INR, LFT’s, Troponin, CPK with MB, Lactate, Mg, PO$_4$
- Order PCXR post intubation
- Order Head CT to rule out intracranial bleed (Should be done at a convenient time before the “monitoring phase”. Should not delay cardiac cath unless there is a high suspicion of intracranial bleed)
- Insert nasogastric or oral gastric tube
- Document baseline vitals at a minimum of every 15 minutes
- Assess and document baseline skin condition
- Insert an arterial line
- Insert two core temperature monitoring devices (CVP/PA cath or Esophageal temp probe) {connected to temp port #1 on Zoll machine} and (bladder or rectal probe) {connected to temp port #2 on Zoll machine}
- Place Cooling Catheter {Set target temp to 33°C} (may be done in cardiac cath lab)
- Order KUB x-ray to confirm location of catheter tip (may be done with fluoroscopy as well)
- The second core temperature monitoring device should be placed as soon as possible to allow complementary core temperature readings
- Anticipate need for vasopressor support
- Position cooling blanket under patient with sheet between blanket and patient if delay in placing cooling cath
- Intubate patient with ETT
- Sedate patient (consider Propofol or Versed drip)
- Consider narcotics for control of shivering
- Paralyze patient with neuromuscular blocking agents as needed for shivering (consider drip)
- Wrap hands and feet in towels to prevent frost bite and decrease shivering stimulus

Induction Phase:
- Hypothermia procedures should not delay interventional cardiology
- Place cloth protected ice packs in groin and axilla – will be removed when temp is 34°C
- Infuse 30ml/kg of 4°C saline rapid bolus via pressure bag (max of 2 liters) if {the patient is not already at target temperature, additional fluid is not contraindicated, a cold fluid bolus has not already been administered}.
- Do not administer cold saline bolus if obvious pulmonary edema is present
- Place second cooling blanket on top of patient with sheet between blanket and sheet (if delay in placing cooling cath)
- The cooling blankets should not make direct contact with the patient’s skin
- Turn on the cooling blankets in manual mode and set temperature at 4°C
- When patient temp reaches 34°C switch to automatic mode with patient set point of 33°C
- The patient’s temperature should be kept between 32°C and 34°C for 24 hrs from the time target temperature is reached
- The patient should be cooled as fast as possible until target is reached
- The temperature should not go below 32°C
- Document core temperature every 15 min during cooling and rewarming.
- Document core temperature every hour during maintenance.
- Consider continuous EEG monitoring for 48 hrs due to 10-15% incidence of seizures
- Once catheter location confirmed, initiate max cool algorithm on Zoll / Alsius device (set point 33°C)

**Monitoring Phase:**
- Continue to assess patients skin every 2 hrs
- Continuous ECG monitoring (bradycardic rhythms are common)
- Keep Head of Bed elevated at 30°
- Reposition patient q 2° and PRN
- Do not perform invasive thoracic procedures or reposition the patient if temp is < 32°C
- Monitor vital signs per ICU routine
- Mean Arterial Pressure (MAP) goal (80-100 mmHg).
- Use vasopressor support as needed
- Insulin drip as ordered for glucose management
- Maintain CVP between 8-12 mmHg (euvolemia, unless other concerns, ie: CHF)
- Monitor blood glucose every 4 hrs or as ordered per glucose management protocol
- Be sure to avoid heated humidified oxygen on the ventilator
- NG or OG to low intermittent suction
- Avoid maintenance fluid containing dextrose
- Constant assessment for shivering
- Pepcid 20mg IVP q 12°
- Tylenol 650mg NG or PR q6° x 24°
- Avoid bed bath during administration of hypothermia
- Often continuous neuromuscular blockade may be stopped during this phase and used only as needed for shivering.

**Re-Warming Phase:**
- Automatically re-warm the patient after 24 hr hypothermic period complete with Zoll / Alsius cooling cath algorithm pre-programmed in machine. (target temp 37°C)
  o Hypothermic period starts once target temperature is reached
  o The patient should be re-warmed at a rate of 0.1°C – 0.5°C per hour (preferred 0.1°C/hr)
- Neuromuscular blocking agents may be needed during re-warming phase to prevent shivering
- Once warmed, patients may become hyperthermic.
  o Screen for sources of infection (ie. Blood cultures x 2, UA with culture, pCXR, etc.)
  o Tylenol 1000mg PO or PR q 6°PRN Temp > 37.5°C.
  o Consider using active cooling to treat persistent hyperthermia > 38°C
- Anticipate increased CO₂ production during rewarming and possible need for ventilator adjustment

**Special Considerations:**
- Rectal temperature monitoring is the least accurate and is not preferred.
- Avoid IV solutions containing dextrose unless hypoglycemia has developed.
- Watch for clinical symptoms of seizure in paralyzed patient (unexplained tachycardia)
- Avoid hyperventilation
- Perform routine neuro assessment q 4°once rewarming is complete

**Reasons to Abort Cooling:**
- Significant hemorrhage
- Severe and persistent arrhythmia causing hypotension
- Decision to withdraw care or palliative care

**Do not Abort Cooling if:**
- Cardiac arrest – perform ACLS as if patient was normothermic
Diagnostic Studies (Laboratory/Radiology – if not already done)
- ABG, CBC, CMP, Mg, PO₄, INR, PTT, Lactate q 6° x 4
- CPK, CPK-MB q8° x 3
- Troponin q8° x 3
- Potassium q2° during re-warming phase until Temp ≥ 36°C
- LABS: Include patient’s body temperature in order and on label if < 37°C
- Blood sugar per protocol
- PCXR – re: ETT placement, R/O aspiration
- 12 lead EKG q 12° x 2

Neuroprognostication:
- Standard prognostication techniques were developed prior to therapeutic hypothermia
- Recommend waiting at least 72hrs after ROSC before withdrawing care