Title: THERAPEUTIC TEMPERATURE MANAGEMENT FOR POST CARDIAC ARREST PATIENTS

Target Audience:
Physicians and nurses providing care for patients undergoing induced hypothermia therapy.

Scope/Patient Population:
Adult patients in the Emergency Department, Cardiac Catheterization Lab and Critical Care units who have been resuscitated from cardiac arrest and meet inclusion/exclusion criteria for Therapeutic Temperature Management (TTM) therapy. The application of this therapy for other conditions, such as stroke and traumatic brain injury, lacks strong supporting evidence at this time. This guideline is restricted to the use of TTM in post cardiac arrest patients.

Rationale:
Inducing mild hypothermia in patients resuscitated from cardiac arrest has been shown to result in improved neurologic outcomes. Initial studies employed target core temperatures of 32-34°C (mild hypothermia). A retrospective study published ten years after the initial studies demonstrated better neurologic outcomes in patients treated with mild hypothermia vs "normothermia", which allowed temps to 37.5°C. Later studies demonstrated equivalent outcomes targeting core temperatures of 33°C as 36°C (also referred to as normothermia). As of this writing, expert opinion and clinical practice have not settled on a single 'best' target temperature and both are still employed. What is clear is that fever is detrimental to the injured brain and is to be avoided for several days following a cardiac arrest. The use of TTM to provide both mild hypothermia and normothermia will be covered in this guideline.

Objective
Describe current best practice in the application of Therapeutic Temperature Management therapy to patients resuscitated from cardiac arrest and to support the standardization of care across the MultiCare System. The ultimate goals are to employ this therapy appropriately, safely and to achieve the best neurologic outcomes for post arrest patients.

Recommendations:
A. Apply the inclusion and exclusion criteria below:
   1. Inclusion Criteria:
      • Return of spontaneous circulation (ROSC) post cardiac arrest*

* Denotes a key criterion for this guideline.
• Patient remains unconscious prior to sedation
• Able to initiate cooling within 6 hours of ROSC
• Patient is intubated

2. Exclusion Criteria
• Patient hypothermia (≤30°C) at time of admission
• Pregnancy (negative HCG for women less than 50 years of age)*
• DNAR/DNI status or known terminal illness prior to arrest
• Severe pre-existing coagulopathy, active bleeding, severe thrombocytopenia (plts < 30K)*
• Other reason for coma (eg drug ingestion, seizure, head trauma, CVA)
• Pre-existing vegetative state
* pregnancy and coagulopathy may not be contraindications for the application of 'normothermia', ie maintaining 36°C.

B. Witnessed cardiac arrest patients, most commonly with VF or pulseless VT, constitute the optimal patient population for this therapy as it is known with some certainty how long the patient was down. Victims of unwitnessed arrests generally have suffered a longer period prior to resuscitation and thus tend to have worse neurologic outcomes. Asystole and PEA are more common in this group of patients. Clinical judgment must be applied when determining which patients are likely to benefit from TTM.

C. If hypothermic therapy is to be provided, the target temperature should be achieved as soon as possible. The infusion of cold liquids, combined with the use of external cooling such as the Arctic Sun, should bring the patient to the target temperature within 2-3 hours of the initiation of cooling.

D. Patient safety and comfort dictate that sedation and analgesia be provided during TTM in case the patient should regain consciousness, possibly while receiving neuromuscular blockade. Drug metabolism is slowed during hypothermia; front load sedatives and then use relatively low maintenance rates.

E. If hypotension develops during the induction of hypothermia, hypovolemia is the most common cause. Be aware of the phenomenon of 'cold diuresis'. The increase in venous return induced by hypothermia can lead to activation of atrial natriuretic peptide and a decrease in the levels of anti-diuretic hormone. This can lead to a marked increase in diuresis.

F. Electrolyte shifts are expected with the use of hypothermic therapy, requiring frequent laboratory monitoring and adjustment of electrolyte levels. During cooling Mg, K and P04 go down due to renal losses and intracellular shifts. Mg may play an important role in mitigating brain injury as well as preventing arrhythmias. Try to maintain high normal Mg levels. Be aware of the possibility of hyperkalemia during rewarming. If normothermic therapy (36C) is employed, electrolyte shifts are not expected and lab draws may be
less frequent.

G. Shivering slows and may prevent the induction of hypothermia. It also contributes to the development of fever, which must be avoided in these patients. The TTM order set lists several interventions that can be applied to control shivering.

H. There is evidence that hyperoxia is associated with poorer neurologic outcomes and increased mortality in patients undergoing TTM. Pending randomized, controlled studies on this topic, FIO2 should be adjusted to provide a 'normal' pO2 but avoid excessive oxygenation.

I. Patients are more susceptible to infection when cooled. Pay close attention to infection prevention measures and to skin care.

J. Lactate levels frequently rise during therapeutic hypothermia, as high as 6 mmol/L. The lactate level should level off once the target temperature is achieved. If it continues to rise, look for another cause.

K. The optimal duration of TTM is uncertain. Most protocols have employed 20-24 hours at the target temperature. There is animal data to suggest that longer TTM may convey additional benefits but this has not yet been demonstrated in humans.

L. Rewarming from mild hypothermia should occur at 0.3 to 0.5°C per hour until the core temp is 36.5-37.5°C.

M. Once through the initial phase of TTM, whether 33°C or 36°C, measures should be taken to keep the patient's temperature at or below 37.5°C until 72 hours after the cardiac arrest. This may require continued use of the Arctic Sun in addition to antipyretic therapy.

N. A significant number of patients that have undergone TTM (33°C) have shown delayed awakening (>72 hours after cardiac arrest). It is recommended that final neurologic prognostication be delayed until 72 hours after the patient has returned to normothermia (>36°C).

O. See Induced Hypothermia Policy and Order Set for details on the delivery of TTM and the management of patients undergoing TTM.

Evidence:


List of Implementation Items and Patient Education:

Need to complete this section.

Plan to update ICU RNs on new guideline and to educate new ICU RNs as they come aboard.

Plan to disseminate Guideline to doc users.

Patient education reference?
**Metrics Plan:**
Do we need metrics? Should we conduct chart reviews on cardiac arrest patients periodically to see if the guidelines are being followed?

**PDCA Plan:**
Dr. James Taylor

Review every 2 years or more frequently if new data emerge that would warrant a change in the Guideline.

**Point of Contact:** *(This should be a person’s role rather than the person’s name. A name and role may be added.)*

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Attachment A:

An example of an existing style of algorithm using the standard figure for decision, information and action.
Maintain High Index of Suspicion for Sepsis - Definitions

Severe Sepsis Present.

YES

Restore Organ Perfusion -

Obtain Cultures and Start Empiric Antibiotics

Initial Crystalloid (30ml/kg), after first few hours conservative fluid management associated with better outcomes (3,4)

Consider Emergent Surgical Infection

Hydrocortisone Recommended if Hypotensive after volume and/or Pressors – 200 mg IV per Day

Consider Red Cell Transfusion if Hgb ≤ 7.0 mg/dl, Consider Fresh Frozen Plasma and Platelets per Protocol

Maintain Serum Glucose ≤ 180 mg/dl

Discuss Goals of Care and Prognosis With Family As Soon As Feasible

NO

Initiate Vasopressor Therapy – Opinions Differ and Options for Either in First Hour or After Fluid Challenge (4)