Induced Hypothermia after Cardiac Arrest

Study Packet
Directions:

(1) Review order set
(2) Read CC Protocol
(3) Read study packet
(4) Take test
(5) Turn test into CC CNS or Clinical Educator

You may keep the packet, just turn in your test.

If you have any questions or you wish to read any of the referenced material please see CC CNS or Clinical Educator.

Objectives:

1. Describe the methodology and rationale of induced hypothermia for cardiac arrest victims.
2. Review potential complications and management of induced hypothermia and re-warming.

Introduction - Why induce hypothermia after cardiac arrest?

Sudden cardiac arrest is a major public health concern with an incidence of more than 400,000 deaths annually in the United States. In patients successfully resuscitated after cardiac arrest there is only a 5-35% survival rate to hospital discharge. Cardiac arrest survivors suffer from ischemic brain injury leading to poor neurological outcomes and death.

The mechanisms responsible for brain damage after a cardiac arrest are multifactorial. Lack of perfusion to the brain during arrest leads to cerebral ischemia and possible anoxic brain damage. Following the restoration of circulation, reperfusion to the brain occurs and is associated with the production of oxygen free radicals, mitochondrial damage and cell death. In patients who have a return of spontaneous circulation (ROSC) following a cardiac arrest and present in coma, the incidence of poor neurological outcome is high. Recent studies exploring the use of mild to moderate hypothermia (32 - 34 degrees Celsius) for a period of 12 to 24 hours after cardiac arrest, have found improvements in clinical outcomes in some patients. Induced hypothermia post cardiac arrest is no longer just research. This therapy is in the current ACLS guidelines as class I evidence. In comparison, Atropine for Asystole is only class IIB strength evidence.
Areas Involved:
- Emergency Dept
- Cardiac Cath Lab
- Adult Critical Care Units
- Providers: ED physicians and nursing, Cardiologists, Adult Critical Care Intensivists, ICU Medical Residents, Neurologist, Critical Care nursing, Respiratory Therapy

What Patients are candidates?
We are only including adults at this time. Different facilities differ slightly in their inclusion and exclusion criteria. At this point in time we will start with cardiac arrest patients brought in by EMS through our ED and patients suffering cardiac arrest in the hospital if they meet the criteria. Our criteria are:

Inclusion Criteria:
- Non Traumatic pulseless VT/VF Cardiac Arrest with Restoration of Spontaneous Circulation (ROSC)
- Time to initiation of hypothermia is less than 6 hours
- Comatose after ROSC: GCS less than 8, and no purposeful movements to pain
- An estimated interval of 5-15 minutes from patient’s collapse to the first attempt at resuscitation
- An interval of no more that 60 minutes from collapse to the restoration of spontaneous circulation

Exclusion Criteria:
- Awake and responsive to verbal commands following cardiac arrest
- Core Temperature less than 35.0°C following cardiac arrest
- Age less than 18 or greater than 85
- Traumatic full arrest
- Platelet count less than 50,000
- Known coagulopathy (INR greater than 3.0)
- Active bleeding, GI bleeding
- Patient requiring Mannitol therapy
- Conflict with Advanced Directives or DNR status
- Cardiovascular instability as evidenced by: Uncontrollable arrhythmias
- Sustained refractory ventricular arrhythmias
- Severe bradycardia without a temporary pacemaker
- Persistent hypotension defined as a MAP less than 60 mmHg despite adequate IV fluid resuscitation (CVP greater than 6) and stable level vasopressors
- Sepsis as suspected cause of cardiac arrest
• Suspected intracranial hemorrhage
• Major intracranial, intrathoracic or intrabdominal surgery within 14 days
• Gravid pregnancy
• End stage terminal illness
• Comatose state or severe neurologic dysfunction (ie. Dementia) Prior to cardiac arrest

Relative Contraindication
• Drug Intoxication
• Prolonged QT on 12 Lead EKG prior to initiation of cooling

Risks to hypothermia:
• Cardiac arrhythmias such as Ventricular Fibrillation or Bradycardias
• Increased risk of infection. Due to the induced hypothermia, the immune system is suppressed.
• Bleeding/coagulopathy issues; observe coag panel and platelets carefully
• Skin breakdown
• Hyperglycemia

Must haves:
1. Critical Care (MICU) bed stat; Nursing Supervisor needs to be aware of MICU bed need ASAP
2. 1:1 nursing during both phases, so for 48 hrs. This will be a busy patient.
3. Intubated pt. with ETCO2 monitoring (ETCO2 to monitor trends; goal PaCO2 is 34–45)
4. Arterial line for continuous monitoring
5. Central line access for CVP monitoring
6. Do NOT use Heparin solution for pressure line/flush bag. Use only normal saline.
7. Foley catheter with Temperature probe (this slaves to the CoolGard machine to monitor the patient’s temperature and adjust it to what the target temperature is set for).
8. A secondary temperature source such as a rectal or esophageal temp probe, or PA Catheter is needed to ensure accuracy of the Foley temperature. **Esophageal temp is preferred.**
9. Although not required, it is advisable that a Critical Care Intensivist be consulted on the case.

Equipment needed:
If internal cooling:
• CoolGard 3000 hypothermia machine (one stored in adult ICU)
• X-Pert Pumonary Bed
• **Quattro Catheter** (4 Balloon)
• Cool Guard Set up line
• 500 ml/0.9% Saline (B Braun Bag) IVF (machine uses to cool through catheter/not for infusion into body)
• Foley Temp catheter
• Secondary Temperature Probe
• Train of Four with Pediatric electrodes
• EtCO2 box and Cables

**If external cooling:**
• Ice packs to axillae, groin and neck. (If necessary)
• Refrigerated 0.9% Saline IVF for a total of 2 liters to give IV. This total dose to include that given by ED and EMS. Refrigerated fluid may be obtained from the Emergency Department or MICU.
• Wrap-R-Round® chest and leg wraps (obtained from Emergency Department)
• Foley temperature catheter (slave to bedside cardiac monitor)
• Secondary temp probe (slave to Cooling Blanket)

**Methods used to cool:**

1. **Internal cooling** - for many, this is the preferred method. The reasons for this are (1) faster time to reach target hypothermia goal, (2) more accurate, (3) tighter range control, less fluctuations (over or undershooting), (4) data is real time with patient and system data continuously sampled once every 60 seconds, (5) more control with re-warming phase. Negatives to this method are that an invasive line must be placed.

The equipment we have chosen to work with is manufactured by the Zoll Corporation. The hypothermia machine “Alsius CoolGard 3000” cools and will re-warm the patient. There are a variety of catheters made by the company that work with the “Alsius CoolGard 3000” machine. Typically a femoral line is used to cool faster and have the ability to re-warm. We will be using the “Quattro Catheter”. This is placed by the physician into the femoral vein and will reside in the inferior vena cava. With this special catheter, time to target temperature (32°C to 34°C) is about 2 hrs. The “Icy Catheter” (3 Balloon-located in SICU) may be placed in smaller patients or if the “Quatro Catheter” is unavailable.

If the “Cool Line” (2 Balloon) is used, this catheter will be placed in the subclavian or jugular. This catheter is used more for fever management and while it may be adjunctive to cooling the patient it will be much longer to reach target temperature, and thus external methods of cooling may also need to be deployed.
All three catheters work by running very cold saline (cooled by the machine) through balloons on the catheter. No saline is infused into the patient’s system; it just cools the patient internally as blood passes by.

![Image of catheter and cooling machine]

The "Quattro Catheter" is a 9.3 French, 45cm in length and has 4 Heat Exchange Balloons and has 3 infusion ports, similar to other central lines. The "Icy Catheter" is a 9.3 French, 38cm in length and has 3 infusion ports, similar to other central lines as well. "The Cool Line" is a 9.3F, 22cm in length and has 3 infusion ports as well. All three catheters can be used to monitor CVP readings and administer maintenance IVF’s as well as vasoactive medications.

Some patients will not be able to have a femoral line placed. These would include patients who have had an IVC filter or stent placed, or someone with difficult anatomy. These patients may have either surface cooling methods used or may be able to have the subclavian cooling catheter placed.

2. **External cooling** - there are several methods that currently exist to do surface cooling. Since we know that there will be some patients who won’t be able to have the femoral line placed, or perhaps we can’t get them cooled fast enough in the 6 hour window, we would also need this method. EMS will begin in the field to cool patients with refrigerated intravenous 0.9% NS. We may continue this as well to a maximum of 2 liters total. Ice packs to groin, axillae and neck can also be used. In addition we can use the Wrap-R-Round® vest and leg wraps obtained from the ED. The vest wrap will be placed on the patient on arrival to the ED and remain on until Intravascular Cooling is started. Meticulous skin care needs to be done a minimum of q 2hrs.
**Goals and phases:**

**PHASE I: Induced hypothermia:**

**Goal temp:** Target temperature is 32°C to 34°C. (We will generally set goal for 33°C. This is to be done WITHIN 6 hours (the faster the better!) from time of return to spontaneous circulation (ROSC). This hypothermia phase will last 24 hrs from start of IV cooling to re-warming phase. Both time of ROSC and start of cooling phase are to be documented on the electronic dashboard handoff in the comment section.

**Goal MAP** is over 75 mm Hg throughout both phases. The rationale for this is in order to perfuse the brain and lessen ischemia; there must be adequate cerebral perfusion. Some studies had a goal of MAP 70, others at 90. Our team has chosen 75.

**Goal PaCO2** is 35-45 (normocapnia) during both phases

**What to watch for in phase I:**

- Acidosis may be precipitated by hypothermia
- Hypertension due to peripheral vasoconstriction
- Cooling causes diuresis; see volume replacement in order set
- Red skin due to peripheral vasoconstriction
- Hyperglycemia: there is increased insulin tolerance due to hypothermia
- Hypokalemia due to intracellular shift of serum potassium
- May require less pain and sedative medications due to vasoconstriction
- Increased risk of infection (esp. pneumonia and sepsis) due to decreased immune response
  - Meticulous pulmonary toilet (turn q1-2 hrs but gently, preferably place pt. on XPRT® bed)
  - Will get daily PCXR’s - so, you need to look at them daily and correlate with your clinical exam
  - Strict aseptic technique with all invasive lines
  - Wash your hands and make sure visitors do too
  - Absolutely NO sick visitors
  - Blood cultures need to be obtained 12 hrs from start of cooling
  - Communicate to team if other cultures are indicated
- Shivering
- Bradycardias: these are usually transient. This is thought to occur due to the effect of hypothermia on the conduction system. It is usually seen in the early phase of induction when the pt is rapidly cooled. If seen, can slow cooling slightly, but remember the effect of hypothermia won’t be helpful if done after
6 hrs. If the pt becomes symptomatic, notify MD stat and follow ACLS guidelines/orders. Do not stop or interrupt cooling due to Bradycardia.

- **Arrhythmias** - Observe closely for what is known as the J-wave. (Also called an Osborn wave or Camel wave). This usually occurs if the pt is too cold (less than 30°C); but can happen in the mild to moderate hypothermia range. It is most often called a "J" wave, as it looks like an inverted J or fishhook. It can be seen at the junction of the QRS and early part of the ST segment. It is often seen with a prolonged QT interval as well. It is usually seen in the II, III, aVF, V5 and V6 leads. Not completely understood, but experts think this occurs due to the morphology that occurs with hypothermia in the cardiac action potentials of the mid-myocardial and epicardial cells.

Note in the above ECG leads II, III and aVF have the J-wave.

- Do NOT let temp go less than 32°C as Ventricular Fibrillation may occur! This is the other most common cardiac event that can occur besides Bradycardia. If it occurs, follow ACLS guidelines/orders.
- You may see (if ordered) an increase in pancreatic enzymes; this usually resolves in the re-warming and normothermia phase.
- Train of Four sensor may be inaccurate due to peripheral vasoconstriction. Ensure proper placement on ulnar, temporal or posterior tibial nerves. See AACN Procedure Manual for placement standards.

**PHASE II: Re-warming phase:** *(NOTE: this is often the more unstable phase!)*

Target temp is 36.1°- 37°C. The re-warming phase will start 24 hrs after the cooling phase is started. (From the time the intravascular cooling phase was started). The goal is to achieve normothermia within 12 hrs. Faster is NOT better in this phase. Do NOT program the CoolGard 3000 machine faster than 0.25°C to 1 °C.
What to watch for in phase II:

- Warming causes vasodilatation which may lead to hypovolemia and hypotension
- Hyperkalemia
- Warming too fast increases the risk of respiratory acidosis, hyperkalemia, and sudden vasodilatation resulting in severe hypotension
- Monitor closely for shivering; warm blankets can be used, additional orders available on the Re-warming Order Set.

Documentation:

Nursing documentation on the dashboard:

- Time of ROSC (attempt to get this, may be in EMS or ED records)
- Time intravascular cooling phase started
- Time re-warming phase started (this starts 24 hrs from when IV cooling started)
- Time re-warming phase finished (pt is normothermic)

On nursing vital signs flowsheet documentation:

- Vital signs and temperature
- Open "Temperature Regulation" parameter
- Any arrhythmias, complications, related interventions and evaluations

Commonly asked Questions:

1. **Why Foley temp?** There are other alternatives to continuously monitor core temp. However, unless it is via a PA Catheter it may not be as accurate. Studies have demonstrated that even with an anuric patient, measuring the bladder wall temperature may be more accurate than with the rectal probe. However, Esophageal temperature may be more accurate than rectal temperature.

2. **What are alternatives to a Foley temperature, or what can I use for a secondary source for monitoring the body temperature?** Either a rectal temp probe, esophageal, or if a PA Catheter is in place this may be used.

3. **Why do I need to have a secondary source temp?** It is recommended that you monitor a secondary source temperature for two reasons. Reason #1: if sensor on the Foley temp may go bad and be inaccurate. Reason #2: sometimes when the patient is dumping urine from diuresis, the temperature fluctuates. While it is often very short lived or transient, there may need to be intervention. If the temperature difference between Foley and secondary source is more than 1 degree Celsius in difference, consideration of which mode is most accurate needs to be discussed with the physician. It is essential when dealing with temperatures so close (less than 32°C) to
where it would make the patient hemodynamically unstable and cause complications, to ensure accuracy.

4. **Why do I need to correlate EtCO2 with ABG?** EtCO2 will run lower than the ABG pCO2 so watch for trends.

5. **What electrolytes are altered and why?** Anticipate shift of serum potassium intracellular during hypothermia, and shift extracellular during re-warming phase. Do not replace serum potassium during hypothermia phase unless less than 3.0 mEq/L. When notifying physician of electrolyte abnormalities, time to re-warm phase needs to be communicated as this needs to be taken into consideration. Other electrolytes that may need to be replaced if at these levels: Magnesium if less than 2.0 mg/dl, Phosphorous if less than 2.4 mg/dl, and Calcium if less than 8.0 mg/dl. Hyperglycemia is anticipated during cooling phase. Most likely the patient will require an insulin drip. Do not use D10 listed on the Insulin Protocol. Do NOT use finger sticks as this may be inaccurate due to peripheral vasoconstriction. Use either arterial (preferred method) or venous blood for sampling.

6. **Why hypertensive and hypotensive?** During the induction of hypothermia phase, peripheral vasoconstriction occurs and the BP may go up. However, the caveat is that cool makes you diurese and thus the pt may become hypovolemic. See order set for volume replacement: urine output will be replaced 0.5:1 or 1:1 depending on age, quality of heart pump (ejection fraction), presence of heart failure, etc. The cardiologist or intensivist will decide this. Once the patient is re-warmed, vasodilatation occurs, thus the hypotension issue.

7. **Why and what kind of rhythm changes or arrhythmias might I see?** Bradycardia is the most common. Often this is transient; if however it remains, notify MD stat and DO NOT stop cooling. Do NOT allow temperature to go below 32°C as Ventricular Fibrillation may occur.

8. **Why sedate and give analgesics?** If the patient is awake at all, induced hypothermia is NO fun! Meaning, they will be very uncomfortable. And since we need to paralyze them we will need to provide adequate sedation.

9. **Why paralyze?** Centers that have done this for a while but are starting to use only intermittent paralytics. This facilitates cooling the patient and prevents shivers but can mask seizures.

10. **Why do they shiver and why do I need to prevent it?** Shivering is the natural body response to generate heat. If shivers occur during induction phase, you may need to increase sedation, analgesics and paralytics. During re-warming phase you may apply warm blankets to warm externally. If these measures don't work, notify MD for further intervention orders.

11. **Why not bathe?** May cause fluctuations in temperature which may lead to alterations in electrolytes and/or arrhythmias. In addition, temperature fluctuations in either phase and can be harmful to cerebral circulation.
12. **Why 1:1 nursing?** These patients are both time consuming task wise as well as close and careful monitoring of ECG, O2 sat, blood pressure, all lab values, and temperature are essential.

**Don’t forget:**
- The pt did suffer a cardiac arrest. With this may come alterations in every organ system if it was affected or had lack of significant perfusion, so, observe every system for signs of dysfunction.
- Hypoxia may be present; monitor for continued need for high FIO2’s, i.e. watch for something else going on such as ARDS, etc.
- Do not hyperventilate; goal is for normocapnia; low PaCO2 can lead to decreased cerebral perfusion. With peripheral vasoconstriction present already, hyperventilation may cause increases in Peak Airway Pressures, “auto PEEP” and thus lead to decrease in central venous return.
- Hemodynamic status may be unstable for some time.
- If the pt received an anti-arrhythmic associated with ROSC, this will be continued, so be prepared for that.
- A beta-blocker may or may not be started as it is protectant for the heart.
- If cardiac biomarkers are ordered, they may be elevated due to acute myocardial infarction or may be increased in association with global ischemia caused by decreased coronary blood flow.
- Although seizures are not common, they can occur. Call the MD stat and provide routine safety measures to pt. Seizure prophylaxis is not supported by the evidence one way or the other (class Indeterminate at present) so it is usually not ordered.
- Some patients may wake up; others may have a decreased responsiveness for some time. Remember though, that NMBA’s can cause residual weakness 24-72 hrs post use. So, give them some time.

**Key points you need to walk away with:**
- This is NOT research. While we will be collecting data, this is now approved care and is in the new 2010 ACLS standards.
- Watch the patient VERY carefully for arrhythmias, VS, etc.
- Monitor those labs and call when abnormal.
- Keep the temps within target for induced hypothermia phase; fluctuations are NOT good.
- Do not re-warm too fast.
- Do NOT let patient become hyperthermic in the re-warming phase AND afterwards for several days, at least 48hrs. If pt transferred, make sure this is emphasized.
• It is NOT acceptable to leave the pt in the Emergency Department; if MICU unit with empty bed cannot accept pt due to lack of resources, a bed must be made in a unit with available resources STAT. **Time is BRAIN TISSUE!**
• Don’t forget the family. Use your resources of social work, case management and chaplain services. The family and loved ones will need much support.
• Maintain patient normothermic with use of Coolgard machine 24 hours after rewarming phase complete.
• Line must be discontinued prior to transfer to Med-Surg unit.

**Discontinuing the IV Cooling Catheter:**
• Nursing may discontinue the catheter if they are signed-off on central line removal
• Steps
  o Stop all pumping of saline through the catheter
  o Disconnect Start-up Kit from catheter. Uncap or leave uncapped the inflow and outflow lumens of the cooling circuit (cooling circuit ONLY). Using a 10cc syringe attempt to aspirate any saline in the balloons and then **remove** syringe. This will allow residual saline within the circuit to be expressed. As the catheter is withdrawn, the balloons are compressed. Saline within the balloons must be free to pass out of the balloon or the balloon will not deflate making the catheter difficult to remove.
  o Place the patient in supine position. Remove dressing. Remove sutures from suture site.
  o Slowly remove catheter from patient. As catheter exits the site apply pressure with a dressing impermeable to air e.g. Vaseline gauze.
References:


Set-Up of CoolGard 3000

1. Check the level of the coolant in the coolant well, add more fluid if necessary.
2. Plug in the power cord and turn the power switch on.
3. Make the following selections on the system set-up display screens:
   a. System Pre-Cool: Choose YES and press the enter knob to begin cooling the fluid in the coolant well. Choose NO and press the enter knob if you do not wish to pre-cool.
   b. Select Catheter (pump rate): Select the pump rate that is specified for the Alsius catheter you will be using.
   c. Override Secondary Temperature Probe: If you are using a secondary patient temperature probe, choose NO and press the enter knob. Currently, our rectal probes are compatible with the CoolGard 3000 machine. If you choose YES, the patient will be connected to an independent secondary temperature monitor.
   d. Set Target Temperature: Turn the knob to select the desired patient target temperature and press the knob once.
   e. Max Power, Control Rate or Fever: Turn the knob to select the desired power and press the knob once. Do not use the Controlled Rate setting with a Cool Line catheter.
4. Install the start-up kit tubing set.
   a. Insert the heat exchange coil into the coolant well.
   b. Insert the air trap into the air trap holder.
   c. Hang 500 ml of sterile normal saline (B Braun Bag) on the hook.
   d. Open lid of roller pump. The large section of tubing goes into the roller pump.
   e. Manually rotate the pump to facilitate loading of tubing (see quick reference guide attached to machine).
   f. Load the pump tubing into the pump, following the tubing circuit diagram printed on the inside of the machine’s top cover. Side of tubing with flange fits into the slot on the right side of the roller pump housing.
   g. Firmly close the top cover of the pump.
   h. Using aseptic technique, connect the tubing to the 500ml normal saline using the spike connector.
   i. Lift out the air trap from its holder and turn it upside down. Press and hold the PRIME switch until the air trap and tubing are completely full of saline (approx. 2 minutes).
   j. Tap the air trap gently to dislodge bubbles.
   k. Turn the filled air trap right side up and place it in the holder.
   l. Slip the insulating jacket over the saline container.
m. Route the tubing out of the machine through notches in the front of the console and through the channel at the rear of the console.

n. Close the top cover.

5. Catheter preparation and insertion

   The ALSIUS Cool Line, or Icy catheters must be inserted by staff trained in the Seldinger Technique for the insertion of a central venous catheter and be either a licensed medical practitioner or appropriately trained and under the supervision of a licensed medical practitioner.

   a. Prime infusion lumens before insertion per hospital standard guideline for CVC.

   b. Remove caps from the inflow and outflow luer. Keep the balloon cover on during the prime with a 5cc syringe.

   c. Remove the balloon cover prior to insertion

   d. Insert catheter over a guidewire to subclavian (Cool Line only), jugular (Cool Line only) or femoral (Cool Line and Icy).

   e. Kit includes all accessories needed for insertion. Do not substitute components for those contained in the Alsius catheter kit as it may hinder performance.

   f. Dilator and scalpel should be used to enlarge the cutaneous and vessel puncture site and to ensure the ease of insertion.

   **Caution:** Don't over torque the catheter when inserting (twisting to get it in)

   g. Advance catheter to ensure that balloons reside completely in vessel.

   h. Don't suture directly to the catheter

**Connection to the Patient**

1. Alsius catheter is placed in patient by trained physician.

2. Position the CoolGard 3000 near the patient’s bed and lock the casters.

3. Place the primary and secondary patient temperature probes in the patient.
   
   a. Plug the cable from the primary temperature probe into T1.

   b. Plug the secondary temperature probe into the cardiac monitor.

4. The supply and return connectors of the tubing are connected to each other. Use aseptic technique to disconnect the two catheters.

5. Connect the male tubing connector to the female connector on the patient’s Alsius catheter.

6. Connect the female tubing connector to the male connector on the patient’s Alsius catheter.

7. Position the tubing so that it is not kinked, obstructed, or cannot be dislodged by the patient’s movement.

8. Press the STANDBY/RUN button to place the CoolGard 3000 in the Run mode.
Temporary Disconnection from the Patient
1. Press the STANDBY/RUN button to place the CoolGard 3000 in standby mode.
2. Disconnect the temperature probes from their cables. Leave the temperature probes in the patient.
3. Using aseptic technique, disconnect the saline lines from the Alsius catheter and cap all lines or connect them to each other.

Reconnecting After a Temporary Disconnection
1. Using aseptic technique, reconnect the saline tubing to the Alsius catheter.
2. Reconnect the temperature probes to their cables.
3. Restart the CoolGard 3000 by pressing the STANDBY/RUN button.

Ending Treatment
1. Press the STANDBY/RUN button. The pump stops turning and the Standby screen appears.
2. Using aseptic technique, disconnect both tubing connectors from the Alsius catheter.
3. Disconnect the primary and secondary patient temperature probes.
4. Press the knob one, select END PROCEDURE, and press knob once to confirm.
5. Prior to catheter removal, uncap and leave uncapped the inflow and outflow lumen. This will allow residual saline within the circuit to be expressed.

Other tips:
1. The catheters are MRI compatible.
2. DO NOT RUN MANNITOL thru the catheter if the patient is being cooled. (Mannitol may run through the Alsius catheter, however the machine must be put on STANDBY for two minutes and the lumen must be flushed after the Mannitol has infused. This is to ensure the medication has not crystallized.)
3. The Cool Line catheter can be used up to 7 days and the Quattro and Icy Line (femoral) can be used up to 4 days.
4. Check the coolant level each time the machine is initially started. The coolant contains propylene glycol and distilled water. The nurse will only need to add distilled water or propylene glycol, if needed.

References:
HYPOTHERMIA POST TEST

Name __________________________ Date __________

Directions:
When done, remove this page from the study packet and give to member of your unit management. You will receive up to 2 management approved hours when completed. Circle or write in correct answer as is applicable.

1. True or False - Induced hypothermia for post cardiac arrest is in the new ACLS guidelines and is considered class I evidence.

2. In the induction or cooling phase the target or goal temperature is _______ degrees Celcius. And the goal to get to that temp is ____ hours.

3. True or False - We will initiate induced hypothermia in patients with active DNR orders.

4. True or False - All patients eligible for induced hypothermia will require an Intensivist consult.

5. In the initial cooling phase how many total liters of 0.9% IV can be given?

6. Circle the correct answer - The first 24 hrs of cooling begins from the time which area begins the cooling process?
   Emergency Department or EMS or start of IV cooling

7. True or False - Both the time the cooling phase was initiated and the time re-warming phase was initiated must be documented nursing electronic documentation.

8. Circle the correct answer - Which is most likely to occur during the cooling phase?
   Hypokalemia / hyperkalemia and hyperglycemia / hypoglycemia

9. True or False - It is acceptable to administer the neuromuscular blocking agent followed by analgesia and / or sedatives.

10. True or False - It is acceptable to use a Heparin flush bag for the pressure lines in these patients.
11. The goal in the re-warming phase is to bring the pt safely back to normothermia. The time to accomplish this goal is within ____ hours to ____ hours?

12. Circle the correct answer - Hyperthermia / hypothermia within the first 48 hrs post hypothermic treatment can be especially detrimental to neurological function and needs to be carefully monitored and treated to maintain normothermia.

13. Circle all that are correct answers - When the body becomes cold you should expect:
   a. Diuresis
   b. Acidosis
   c. Red skin
   d. Requiring more pain medication
   e. Shivering

14. Circle correct answer - During the re-warming phase, the patient may become hypotensive due to vasoconstriction or vasodilatation?

15. True or False - Patients with induced hypothermia are not at a higher risk of infection.

16. The MAP goal is over ____

17. True or False - Hyperventilation is a necessary component for these pts as it increases blood flow to the brain via further vasoconstriction.

18. True or False - During the re-warming phase, it is a good idea to stop any warming methods such as use of warm blankets if the temperature goes over 97°F or 37°C.

19. What does ROSC stand for? ___________________________________

20. It is essential to carefully monitor the core temperature during the induction of hypothermia phase every ____ minutes until target temp is achieved, and then monitor every ____ minutes for the remainder of this phase.

21. When re-warming, you must monitor core temperature every ____ minutes until normothermia is achieved. (hint, look at order set)