Protocol for Hypothermic (32C to 34C Degrees) Targeted Temperature Management (TTM) in Critical Care Post Cardiac Arrest

This checklist/protocol provides instructions to health care providers for the initiation, maintenance and discontinuation of HYPOTHERMIC (32C to 34C Target) Temperature Management (TTM) in the Adult Critical Care Units, London Health Sciences Centre (LHSC).

For patients being treated with normothermic TTM, use the Protocol for Normothermic TTM.

The goal is to reach the target temperature as quickly as possible after ROSC. When a target temperature of 32C to 34C has been ordered, begin cooling immediately following ROSC. Patients undergoing Hypothermic TTM will be actively cooled and deeply sedated for 40 hours. For the remainder of the 72 hour protocol, fever prevention (less than 37.1C) is the priority.

This protocol should not be used in patients with severe shock, coagulopathy, massive hemorrhage protocol, terminal disease or severe infection (consider normothermic TTM if appropriate). This protocol should only be used in patients who are not spontaneously following commands.

Maintain target temperature if investigations are required. Patients should not be allowed to waken or breathe spontaneously; if they do, sedation and analgesia is inadequate. This checklist covers the 72 hours of TTM protocol.

Central venous and arterial access should be established (for rapid secure vascular access, administration of cold fluids and potential vasoactive/pacemaker. Cooling *should not be delayed* for the insertion of a CVC/arterial line. Central line insertion is not contraindicated during hypothermia. Bradycardia is common when patients are hypothermic and does not require treatment if patient is stable with an adequate MAP and urine output.

Time Points (in Hours):

T1: Time point when the patient's temperature first reaches target (e.g., 34)

T40: Time point for the end of active cooling and initiation of sedation withdrawal.

T72: End of targeted temperature management period.

T1-T40: Time period of active cooling and deep sedation.

T40 to T48: Time period of passive rewarming.

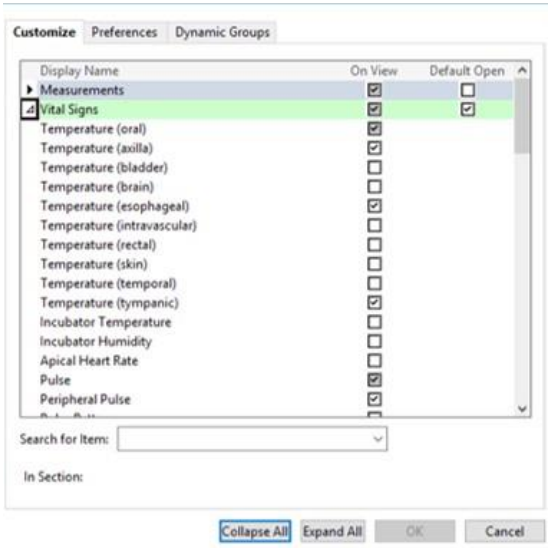
T40-T72: Fever prevention period; keep temperature less than 37.1C. If temperature exceeds target, sedation and/or other cooling methods may need to be reinstituted.

INITIATION OF HYPOTHERMIC TTM (32C TO 34C): T1 TO T40 PROTOCOL REQUIREMENTS

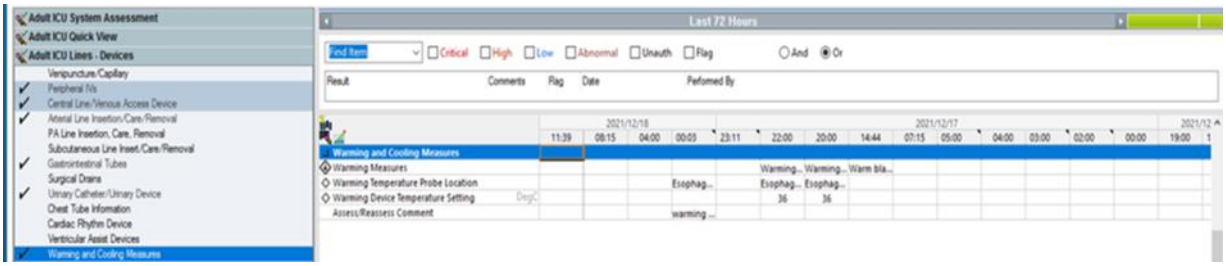
- If patient has indications of an acute STEMI, Code STEMI should be activated. Temperature control is not a contraindication to coronary intervention.
- If patient has cardiogenic shock or persistent arrythmia, Critical Care Consultant/Senior Resident should engage Cardiology STAT for cardiac catheterization consideration.
- Administer ASA, antiplatelet agents, anticoagulant and/or fibrinolytics as per orders for Acute Coronary Syndrome.
- Temperature range: 32C to 34C
- Standard analgesia orders should be discontinued and replaced with BOTH analgesic and sedative orders contained within the TTM protocol to provide anaesthetic level dosing.

DOCUMENT WARMING AND COOLING INTERVENTIONS

Ensure that the correct temperature is recorded. Label the bedside temperature as esophageal. If necessary, go to IView – Vital Signs – Custom View and Vital Signs to select Temperature Esophageal.



Document when warming and cooling stop and start. In the comments, identify strategy used (e.g., cold saline, cooling/warming blanket, acetaminophen initiated, NMB).



STEPS TO ACHIEVING HYPOTHERMIA

- Notify RRT STAT to ensure full controlled ventilation is established and humidifier is set at 32C (NIV mode).
- Quickly perform a BRIEF baseline neurological assessment including GCS, pupils, corneal reflex, gag and cough, then PROMPTLY initiate sedation by bolus administration.
- Initiate continuous nasopharyngeal or esophageal temperature monitoring (probe insertion instructions) and document hourly. A bladder or pulmonary artery catheter can also be used for core temperature monitoring. Rectal temperature monitoring can be used temporarily but can be less accurate (particularly if stool is present). Monitor temperature continuously and document hourly until T72.
- Administer a liberal bolus dose of narcotic and sedative. If temperature is greater than target, **administer an initial 250 ml cold saline bolus immediately following narcotic and sedative administration.** Do not delay cooling until infusions are initiated.
- **Repeat 250 ml** cold normal saline bolus using 250 - 500 ml refrigerated bags (to ensure solution remains cold to end of infusion) to a maximum of 2000 ml if temperature remains greater than 34C.
- Repeat narcotic bolus and initiate infusions (start cooling as soon as first bolus dose is given); don't wait until infusion is started). Titrate narcotic and sedative infusions to ensure the following:
    - No response to a tap on the forehead
    - MAAS 0
    - CPOT 0
    - No respiratory effort

Patients should NOT be allowed to waken or trigger the ventilator during first 40 hours.

- Once above criteria is maintained with narcotic and sedative infusions, administer a bolus dose of neuromuscular blocking agent if necessary for temperature management or ventilator control. Not all normothermia patients will require saline or neuromuscular blockage. Rocuronium is preferred (cost) as an infusion unless severe renal or hepatic impairment.
- Repeat neuromuscular blocking agent bolus and/or initiate an infusion if VAMAAS 0A and CPOT 0 *AND* patient is making respiratory effort/triggering ventilator, shivering or if target temperature remains above goal. Always treat with narcotic or sedative first to ensure anaesthetic levels of sedation.
- Place cooling blanket over TOP surface of patient. Place a light sheet between the patient and blanket (no cooling blanket under patient (pressure injury risk) or directly in contact with skin (frost bite risk).
- Wrap arms and legs in a flannelette blanket to prevent shivering and frost-bite.
- Add ice packs around neck, in axilla and groin if required.
- If patient is on CRRT, turn heater off.
- Identify the time point when target temperature is first achieved. This will be T1.
- If patient's temperature is below 32C, discontinue active cooling. Active warming should only be initiated it temperature remains less than 32C and discontinued when temperature reaches target range.
- If triggering on the ventilator is noted or patient shows any signs of responsiveness or movement, bolus the patient with additional narcotic and increase the maintenance infusions of sedatives until deep anesthesia is achieved. Do not allow the patient to lighten during first 40 hours.

- Initiate **regular** dose acetaminophen (as soon as temperature reaches 36.5C and continue QID. Once started, continue for duration of protocol. If oral route is contraindicated, obtain an order for rectal administration.

SEIZURE MONITORING

- Initiate CEEG (for all patients on normothermia protocol). Continue until T72, patient is awake or discontinued by provider (whichever comes first).
- Consult Neurocritical care (Monday to Friday) if seizure activity is suspected or myoclonus observed. Consult Neurology on evenings and weekends.
- Neurocritical care is able to view CEEG information from the central station from either campus. If you identify something concerning on the CEEG, identify the exact time of the event to help NCC isolate the CEEG finding in full disclosure.
- Although not 100% reliable, an SEF of less than 4 suggests that the patient is deeply sedated.
- The preferred treatment for myoclonus is valproate. Adult Critical Care physicians may order the first dose but Neurology or Neurocritical care consultation is required for ongoing approval.
- Note that neuromuscular blocking agents are not anticonvulsants but they can mask detection of a motor seizure.

MONITORING, MAINTENANCE AND NURSING CARE

- Send TSH for patients who were spontaneously hypothermic at admission.
- If it is difficult to maintain target temperature of 32C to 34C or there are any other signs/risk factors for possible sepsis, culture patient at admission and review need for empiric antimicrobial therapy with provider.
- Bradycardia is common, especially at 32-34 C target. Bradycardia does not require treatment if the patient is stable with an adequate blood pressure and urine output.
- Review MAP target with provider (65 for most patients). To date, there has not been an optimum MAP target in the post-arrest patient.
- Ensure that ECG, electrical cords and/or pacemaker cables do not come in contact with wet linen
- Continue with routine turning and skin care. Monitor for myocardial irritability during position changes.
- Monitor closely for signs of pressure injury. Do not place cooling blanket under patient (increases pressure injury risk).
- For neurological vital signs, monitor pupils and CEEG changes only until T40, then resume full neuro assessment (pupils should respond when neuromuscular blocking agents are in use).
- Monitor for signs of frostbite/dusky circulation.
- Keep eye lids closed at all times and provide lacrilube **ointment** per order.
- If anti-arrhythmics are required, amiodarone is the usual first line agent unless contraindicated.
- Initiate enteral feeding upon admission unless contraindicated. Initiate enteral feeding at 15 ml/hr (elevated HOB as tolerated) and notify Dietitian for ongoing nutritional assessment.
- Initiate DVT and GI prophylaxis as per standard care.
- If renal function deteriorates and patient is receiving rocuronium, review neuromuscular blocking agent with provider.

END OF SEDATION AND ONSET OF FEVER PREVENTION PERIOD (T40 to T72)

DISCONTINUE ACTIVE COOLING AND BEGIN PASSIVE REWARMING AT T40 AS FOLLOWS:

Avoid rapid rewarming. **The goal for rewarming is a target of 0.2-0.5 degrees/hr.**

1. Stop neuromuscular blocking agents at T40
2. Continue with narcotic and sedative infusions until temperature is greater than 36C
3. Stop any active cooling and apply dry linen (e.g., ice packs, cooling blanket)
4. Allow temperature to passively increase during the next 8 hours (T40 to T48)
5. When temperature is greater than 36C, stop narcotic and sedative infusions. Review timing with provider if patient is in renal failure and received rocuronium.
6. Administer PRN narcotics and sedatives for symptom management or to treat shivering, seizures or agitation.

ACTIVE REWARMING (IF REQUIRED) INITIATE AT T48 IF REQUIRED

- If temperature remains less than 35C at T48, review sedation/analgesia administration goals with physician
- Initiate warming blanket if temperature is less than 35C
- Continue to monitor core temperature (not oral or axilla) and turn warming blanket off once temperature reaches 36C
- Monitor for seizures and treat as ordered
- Continue with PRN analgesics and sedatives for symptoms management, to prevent seizures and to keep temperature below 37.1C
- Watch for rebound shivering during rewarming and treat with PRN narcotics, sedatives and by wrapping limbs in flannel sheets.
- **Keep temperature below 37.1C between T40 and T72**

FEVER PREVENTION PERIOD (T40 TO T72)

During this period fever avoidance remains critical. Maintain temperature less than 37.1C as follows:

- Monitor core temperature continuously and document hourly.
- Turn warming blanket off if temperature is > 36
- Initiate regular dose acetaminophen if temperature is greater than 36.5C as ordered
- Monitor for sepsis and culture/treat as indicated
- If temperature exceeds 37C between T40 and T72 and patient is NOT fully awake, reintroduce cooling in the following sequence to maintain temperature below 37C:
    1. Minimize clothing/linen
    2. Administer regular dose acetaminophen as ordered
    3. Use non-heated humidification on the ventilator circuit and CRRT circuit.
    4. Restart sedation until temperature is within target or VAMASS 0 (lowest dose required)
    5. Initiate cooling blanket
    6. Add ice packs in axilla and groin
    7. Initiate neuromuscular blockade
    8. Rule out sepsis

OTHER CONSIDERATIONS

- Continue CEEG until order received to discontinue
- Most patients with persistent coma at 72 hours will require neuroimaging (CT head, MRI brain) and formal EEG.
- Patients should have assessment of cardiac function (formal echocardiogram or POCUS)
- Review with team the need for Neuro Critical Care Consult (usually at 72 hours or later).
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Last Revised: December 15, 2022); January 27, 2023 (BM)