# Targeted Temperature Management (TTM) after Cardiac Arrest Protocol

## Scope
- ICU
- Emergency Department
- Medical Staff
- Nursing Staff

## Purpose
The purpose of this protocol is to outline in detail the induction of TTM.

## Policy
- Commencement, continuation and cessation of cooling will be determined by appropriate department registrar/consultant.
- Induced TTM is to be instituted as soon as possible after Return Of Spontaneous Circulation (ROSC) has occurred, ideally by the treating paramedic team in the field before arrival at the emergency department (ED), but if this has not occurred, then in the ED.
- All patients receiving TTM will have continuous monitoring of body core temperature.
- All patients receiving TTM will be cooled for a period of at least 24 hours.
- Avoid and manage fever (T>37.5°C) for at least 72 hours.

## Definition
- Targeted Temperature Management (TTM) or Strict Therapeutic Normothermia (STN) is used in an effort to protect patients who have suffered cardiac arrest and who remain unconscious, against global cerebral ischaemia.
- TTM/STN consist of 4 phases:
  - Inducing cooling or gentle rewarming to achieve normothermia.
  - Maintenance of strict normothermia.
  - Passive (or Active) Rewarming.
  - Neurological Assessment.
- In the past TTM was targeted to 32-34°C however there is no evidence to suggest decreased poor neurological recovery compared to targeting normothermia (36±0.2°C).

## Indications
- TTM or STN is recommended in adults with out-of-hospital cardiac arrest (OHCA) with an initial shockable or non-shockable rhythm who remain unresponsive (comatose) after ROSC.
- TTM is recommends in adults with in-hospital cardiac arrest (IHCA) with any initial rhythm who remain unresponsive (comatose) after ROSC.
- TTM should be considered in adults with in- or out-of-hospital cardiac arrest who are pregnant on an individual basis.

## Contra-Indications
- Absolute
  - Patient not a candidate for ICU admission (as per treating consultant and / or treating intensivist or emergency physician) as they have:
- A terminal illness pre-dating the cardiac arrest
- A pre-existing treatment limitations
- Very poor functional status
- A high burden of co-morbid disease

**Relative**
- Severe sepsis
- Active bleeding
- Coagulopathy

### Pre-hospital Management

The use of rapid infusion of cold intravenous fluids is NOT recommended in the pre-hospital setting. This is due to lack of evidence showing a decreased risk of poor neurological outcome compared with no initiation of prehospital induced hypothermia, and an increased risk increased rate of re-arrest and pulmonary oedema.

### Initial Management

- Patient intubated and mechanically ventilated if not already so
- Invasive haemodynamic monitoring instituted early by:
  - Intra-arterial blood pressure
  - Central venous pressure

### Assess and Document Comprehensive Patient Assessment

- Cardiac status: rate and rhythm, haemodynamics, interventions and therapy administered
- Neurological status
- Baseline temperature

### Four Phases of TTM

**Inducing cooling or gentle rewarming to achieve Normothermia**

- Aiming to achieve core temperature within four hours
- Cooling by:
  - Using cold (4°C) saline IV bolus 30 ml/kg – as clinical condition allows
  - Immediately removing clothing
  - See Appendix 3 Other methods of cooling

### Temperature Aims for Time from Cardiac Arrest

<table>
<thead>
<tr>
<th>Time from Cardiac Arrest</th>
<th>Core Temperature Aim</th>
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<tbody>
<tr>
<td>0-28 hours</td>
<td>35.0°C - 36.0°C</td>
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<tr>
<td>25-36 hours</td>
<td>Slow passive rewarming to T &lt; 37.0°C</td>
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<tr>
<td>36 – 72 hours</td>
<td>Normothermia, maintaining T &lt;37.5°C</td>
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### Maintenance of strict Normothermia for 24 hours

<table>
<thead>
<tr>
<th>Core Temperature</th>
<th>Target Temperature</th>
<th>Action</th>
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<tbody>
<tr>
<td>&gt;36.0 °C</td>
<td>35.0-36.0°C</td>
<td>Active cooling</td>
</tr>
<tr>
<td>35.0-36.0°C</td>
<td>35.0-36.0°C</td>
<td>Maintenance of goal temperature, May requiring ongoing active cooling.</td>
</tr>
<tr>
<td>33.0-35.0°C</td>
<td>35.0-36.0°C</td>
<td>Passive</td>
</tr>
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</table>
Rewarming

From 28 hours post cardiac arrest to 36 hours post arrest

<table>
<thead>
<tr>
<th>Core Temperature</th>
<th>Target Temperature</th>
<th>Action</th>
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<tbody>
<tr>
<td>35.0 – 36.0°C</td>
<td>37.0°C</td>
<td>Passively rewarm ~0.25°C/hour (cease active measure)</td>
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Maintaining Normothermia 36-72 hours post-arrest

<table>
<thead>
<tr>
<th>Core Temperature</th>
<th>Target Temperature</th>
<th>Action</th>
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<tbody>
<tr>
<td>~37.0 (Normothermia)</td>
<td>Maintain the core temperature below 37.5 C</td>
<td>Warm or cool appropriately</td>
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</table>

Neurological Assessment

- Assessment will be made when the patient is normothermic (36.5°C- 37.5°C)
- This will generally be 36-48 hours following the arrest
- Unless patient agitation prevents this, assessment should be made at a time that has ensured sedative and relaxant drugs have been cleared, which should be a minimum of 6 hours following cessation and sedation
- Consider benzodiazepine and opiate reversal if indicated
- If sedatives are required, lowest possible doses should be
<table>
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<tr>
<th>Used</th>
<th>It is preferable to use sedatives with short-half-lives</th>
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<tr>
<td></td>
<td>The neurological assessment should include (if possible):</td>
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<tr>
<td></td>
<td>- Brainstem reflexes and cranial nerve exams (including pupillary light reflex, corneal responses, supraorbital nerve, oculocephalic reflex, gag, cough), GCS and plantar responses</td>
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<tr>
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<td>- Referral to medical/neurology unit may be necessary to consider:</td>
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<td>- Baseline electroencephalogram (EEG)</td>
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<td>- Further EEGs as determined by patient condition.</td>
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<td></td>
<td>- Somatosensory evoked potentials (SSEPs)</td>
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</table>

| Other methods of cooling and warming | Cooling blankets such as Medi-Cool kit. See Appendix 2 Laerdal MediCool Cooling/Travel kit indications for use. |
|                                      | Application of ice-packs or ice in large plastic bags or cold-packs: head, neck, axilla and limbs until achieved. To be removed on achieving target temperature |
|                                      | Note: Skin must be protected from direct contact with ice or cold packs to prevent skin burns |
|                                      | Tepid bathing with fans |
|                                      | Wind tunnel and fan. Ensure the sheet is not covering the back of the fan to optimize forward air movement. Spray the sheet with water will assist with cooling the air. |

| Body Core Temperature Monitoring | Nasogastric temperature probes |
|                                 | Rectal temperature probes |
|                                 | In line urinary catheter probes |
|                                 | Bladder probes |

| Other considerations | Pregnancy |
|                      | Data for TTM in pregnancy is scant, and should be considered on an individual basis. |
|                      | If TTM is used in pregnancy, TTM should follow the same guideline as for non-pregnant patients |
|                      | Fetal monitoring should be performed throughout TTM |
|                      | Management of feeding |
|                      | Trickle feed only whilst active cooling in process until temperature reaches >=35°C |
|                      | Management of Problematic Shivering |
|                      | Bolus dose neuromuscular blocker; ensure patient adequately sedated first as required |
|                      | Other Management of Post-Arrest Patients, as Clinically indicated |
|                      | Anti-aryrrthmics |
|                      | Aspirin |
|                      | Beta blockers |
|                      | Lipid lowering agent |
|                      | Glycerol trinitrate |
|                      | Therapeutic systemic anti-coagulation |
|                      | Deep vein thrombosis prophylaxis |
|                      | Stress ulcer prophylaxis |
|                      | Potassium and magnesium replacement |
|                      | Glycaemic control |
Revascularization strategies

Troubleshooting

My patient becomes too cold:
- We are aiming for a temperature of 32° - 34°. If your patient’s temperature falls below 32° start PASSIVE re-warming.
- Inform the Registrar or Consultant
- Remove all cooling devices
- Cover with a clean blanket. Do not use the warming machine or warm blankets. This would be ACTIVE re-warming which we do not want
- Keep a close watch on temperature. Above 34° and you need to recommence cooling

My patient is too hot:
- Occasionally patients have a temperature of 40° or more. Unfortunately this is usually poor prognostic situation; however cooling is still recommended
- Your MediCool kit will absorb temperature quickly so will need changing more frequently. There are additional measures you can take to assist cooling
- Ask your medical team to consider I.V. Panadol or liquid Panadol via the N.G. Tube. Note, I.V. Panadol can drop the blood pressure so observe for this effect
- Wet areas of skin not covered by the cooling kit and fan the patient. The more fans the better. This will increase skin evaporation and cooling

My patient becomes bradycardic:
- Bradycardia is a protective mechanism but obviously we need to maintain output
- If the blood pressure is stable, report the rate to the Registrar but maintain cooling
- If the patient is hypotensive with the bradycardia, death can follow. You need to act quickly
- Remove all cooling devices. Start PASSIVE rewarming and consider inotropes
- The Consultant MUST be consulted. They will advise the following:
  - Should Active re-warming commence?
  - Should the Cooling Protocol be discontinued permanently?
  - Can we bring them up to 34° and maintain blood pressure with Nor Adrenaline?

Cooling enhances the patient’s neurological outcome. If you can maintain adequate cardiac output and keep the patient at 34°, you will be giving them the best chance possible

My patient is shivering:
- Shivering is normally treated by paralysing the patient. This is not ideal as it can mask fitting and other symptoms
- Shivering tends to occur within the temperature band between 35.5°C and 34.5°C.

Related Bendigo Health
- Care of the Invasively Ventilated Patient – Adult Patient
- Intensive Care Unit- ICU Referral & Admission
<table>
<thead>
<tr>
<th>Documents</th>
<th>References and Associated Documents</th>
</tr>
</thead>
</table>
• Australian and New Zealand Committee of Resuscitation (ANZCOR) Guideline 11.8 – Targeted Temperature Management (TTM) after Cardiac Arrest. The ARC Guidelines. 2016  

**MANDATORY INCLUSION**

*Personal information and health information as defined in the relevant Victorian law, which is required to be collected, used, disclosed and stored by BHCG in order to achieve the Purpose of this policy, will be handled by the Group and its employees in accordance with their legal obligations.*

*When developing this policy, BHCG has taken all reasonable steps to make its content consistent with the proper discharge of its obligations under the Charter of Human Rights and Responsibilities Act 2006*

<table>
<thead>
<tr>
<th>Responsible Department &amp; Position</th>
<th>ICU – Clinical Nurse Consultant</th>
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<tbody>
<tr>
<td>Approved By</td>
<td>Acute Health &amp; Clinical Support Services Clinical Standards Committee</td>
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<td></td>
<td>Specifies the governing committee that approved the contents of the document.</td>
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<td>Authorised By</td>
<td>Group Clinical Standards Committee</td>
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<td>Specifies the governing committee that authorises the documents application across the organisation or notes the documents existence when the document is single unit specific.</td>
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<td>12/10/2017</td>
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Appendix 1 Laerdal MediCool Cooling/Travel kit Indications for use

The Laerdal MediCool Cooling/Travel kit has been designed to be used to cool down patients – Mild Induced Hypothermia without using ice or ice packs. The kit is intended to be used as one unit i.e: Cap, Blanket, Groin & Axilla Pads should be applied together on the patient.

The Laerdal MediCool is a kit intended to actively cool patients down to 30° – 34° C. Studies indicate the Mild Induced Hypothermia (30° – 34° C) may be beneficial in reducing severe neurological impairment following cerebral ischemia during Cardiac Arrest.

The exact mechanism of the cerebral protection is not clear. It has been postulated that possibly multifactor chemical and physical mechanisms are in play. Hypothermia reduces metabolic demand. Neurotoxic transmitters and extra cellular glutamate release decreases, the inflammatory process is suppressed, and cell membrane stabilized.

Mild Induced Hypothermia is now an accepted adjunct to management protocols for the treatment of patients with Post Cardiac Arrest.

Cautions and warnings:

Cooling may be discontinued if complications occur, or if the Intensivist requires re-warming to commence.

Staff members are made aware of policy availability at orientation. Managers are to advise staff of relevant policies at induction and regularly at staff meetings. Staff training must be made available to fulfil policies and procedure intent where relevant. Access must be freely available to policy and procedures. Major policies and procedures are highlighted by internal communication and Department Head Meetings.

Constantly monitor the Laerdal MediCool application to insure that the patient’s skin is not being irritated by the cold.

Limited warranty:
The Laerdal MediCool kit is warranted against defects in workmanship and materials only. Please refer to the Global Warranty statement for additional terms and conditions (www.laerdal.com).

Items included:
- 2 cooling blankets with zip top plastic pillow case.
- 2 cooling cap with press seal plastic bag.
- 4 axilla cooling pads with press seal plastic bags.
- 4 groin cooling pads with press seal plastic bags.
- Directions for Use.

Intended use:

Target group needs to be assessed before implementation of cooling. Patients with witnessed arrest/collapse of presumed cardiac origin with either VF or VT on initial E.CG.

Estimated time of between 5 to 15 minutes from the patient’s collapse to the first attempt at resuscitation by emergency medical personnel. An interval of no more than 60 minutes from time of collapse to restoration of spontaneous circulation. Patients should be unable to obey command on arrival to hospital.
- Prepare the **Laerdal MediCool** cooling kit as per instructions on next page and place in a freezer.
- Record E.C.G.
- Insert temperature probe, connect to monitor and record base line temperature.
- Get one set of the cooling kit in the same colour; cap, blanket, 2 groin pads and 2 axilla pads and place them on the patients.
- Remember to tuck groin and axilla pads well into position.
- Record regular temperature. At least hourly or according to local protocol.
- When kit warms up (after approximately 2 hours) remove the kit from the patient and into the freezer (remember to put the kit back in to the plastic bag before putting it into the freezer) and apply the second set in a different colour to the once coming off the patient, from the freezer to the patient. Continue to alternate kits as long as cooling is required.
- At cessation of cooling discard according to local protocol.

**General tips:**
Commence surface cooling as soon as possible. Fanning the patient will assist the cooling process. Target temperature of 32°C – 34°C maintained for 24 hours from start of cooling. After approximately 24 hours allow passive re-warming. Or follow local protocol.

**PRACTICAL OPERATIONS:**

**Blanket**
- Initially soak blankets in water for 30-35 minutes until crystal in pockets becomes a gel. **Blanket is now activated and ready to use.** Activated gel pockets should be firm and round in shape but not bursting. Use hand or finger to distribute the gel evenly along the pockets.
- Towel off excess water.
- Place each **activated** blanket in the plastic pillowcases provided and place in freezer. Freezing for a minimum of 2 hours achieves best results.
- The blankets should be rotated from the patient to the freezer approximately every 2 hours.
- Wipe the pillow care covering the blanket with neutral detergent prior to placing in the freezer. This will reduce contamination from patient to your freezer compartment. If you patient has an infectious disease, remove the blanket from the contaminated pillow case and place into clean cover before placing the blanket into the freezer.

**Cap**
- Initially soak in water for approximately 30 minutes until crystal becomes a gel. **Cap is now activated and ready to use.** Activated gel pockets should be firm but not bursting. Again smooth along the pockets to ensure even distribution of the gel.
- Towel off excess water.
- Place in clip seal plastic bag provided and place in freezer.
- Rotate with blanket.
- The cap is removed from the plastic bag for application to the patient.
- Before replacing the cap into its bag for re-freezing, insert a plastic bag inside the cap. This will prevent the two surfaces of the cap together.
Pads
• Initially soak all pads in water for approximately 30 minutes until the crystal becomes a gel. Pads are now activated ready for use. Activated gel should be firm but not bursting. Use fingers to ensure even distribution of the gel in the pad.
• Towel of excess water.
• Place each pad in clip seal plastic bag provided. Place in freezer. Rotate onto patient with cap and blanket. Prior to rotation back to freezer from the patient place all pads into a clean plastic bag to prevent contamination of your freezer compartment.

Appendix 2 Methods of Cooling and Warming
1. Other acceptable Cooling Method
   a. Cooling blankets such as Medi-Cool kit. See the following: Laerdal MediCool Cooling/Travel kit indications for use.
   b. Application of ice-packs or ice in large plastic bags or cold-packs: head, neck, axilla and limbs until achieved. To be removed on achieving target temperature
   Note: Skin must be protected from direct contact with ice or cold packs to prevent skin burns
   c. Tepid bathing with fans
   d. Wind tunnel and fan. Ensure the sheet is not covering the back of the fan to optimize forward air movement. Spray the sheet with water will assist with cooling the air.
2. Body Core Temperature Monitoring. Acceptable Methods Include:
   a. Nasogastric temperature probes
   b. Rectal temperature probes
   c. In line urinary catheter probes
   d. Bladder probes
3. Troubleshooting See Appendix 1.