

TARGETED TEMPERATURE CONTROL - CICU - SCH

PRACTICE GUIDELINE [®]

DOCUMENT SUMMARY/KEY POINTS

- The intentional control of core body temperature can be applied for the management of a variety of acute conditions.
- The concept that fever is deleterious to the injured brain is endorsed by the literature and temperature control appears to be a prudent step in the management of these patients.
- The method of temperature control may be chosen based on specific parameters, such as induction rate to target temperature, stability of temperature control, adverse events, profile of physiologic complications and practicality.
- Sedation and neuromuscular blockade may be required to facilitate cooling and avoid shivering.
- Core temperature is to be continuously measured via an oesophageal temperature probe.

For management of neonates with hypoxic-ischaemic encephalopathy (HIE) as a result of peri-partum asphyxia please refer to SCHN guideline [Therapeutic Hypothermia in the Newborn](#)

This document reflects what is currently regarded as safe practice. However, as in any clinical situation, there may be factors which cannot be covered by a single set of guidelines. This document does not replace the need for the application of clinical judgement to each individual presentation.

Approved by:	SCHN Policy, Procedure and Guideline Committee	
Date Effective:	1 st July 2021	Review Period: 3 years
Team Leader:	Clinical Nurse Consultant	Area/Dept: Children's Intensive Care Unit SCH

CHANGE SUMMARY

- Replaces SCH document C.17.14 “*Surface Cooling & Therapeutic Hypothermia Guidelines*”.
- Inclusion of more clinical indications for Targeted Temperature Control.
- Equipment update. Arctic Sun temperature management system inserted.

READ ACKNOWLEDGEMENT

- All CICU nursing and medical staff are required to read and acknowledge the document

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1 Targeted temperature control (TCC).

Targeted temperature control is the management of a child's core temperature using external methods to facilitate the treatment for a variety of acute conditions.

TTC will enable the maintenance of a child's hypothermic state in the instance of HIE or to reduce oxygen consumption, cooling in the case of Febrile Infection-Related Epilepsy Syndrome (FIRES) or uncontrolled ICP, or the maintenance of normothermia for a child with TBI.

TTC can also be used to maintain warm body temperature for the patient following brain death to facilitate organ donation, the ideal body temperature is >35.8 degrees.

2 Indications for Targeted temperature Control.

- Traumatic Brain Injury with uncontrolled ICP
- Hypoxic Ischemic Encephalopathy (HIE)
- Febrile Infection-Related Epilepsy Syndrome (FIRES)
- Brain death with consideration for organ donation
- Cardiac Dysrhythmias

For Neonatal HIE refer to [Therapeutic Hypothermia for Neuroprotection in Neonates](#)

3 Temperature monitoring

- Monitor the patient's core temperature continuously via an invasive temperature probe connected directly to Draeger monitoring or the Arctic Sun machine. Document patient temperature, machine set temperature and water temperature (if using the Arctic Sun) hourly on the cooling observation chart.
- Core temperature should be measured via an oesophageal temperature probe where appropriate, this should be in the lower third of the oesophagus and may be inserted orally or nasally (if not contraindicated by base of skull fracture) There may be circumstances where an oesophageal probe is contraindicated such as facial injuries – a rectal probe or indwelling urinary catheter temperature probe, in larger catheters (usually 14fg and above), are acceptable alternatives. The difference between the oesophageal and the rectal temperatures is not constant, but rectal temperature is known to lag considerably behind the core temperature, whereas the oesophageal temperature has a better correlation.
- **N.B be mindful that it is possible to tear bowel mucosa when inserting a rectal probe.**
- Remember, in the ventilated patient the oesophageal temperature can be influenced by the temperature of the warmed gases the ventilator is delivering.

4 Surface Cooling

Surface cooling is often used to assist in the reduction of a patient's core temperature to achieve therapeutic normothermia (>35.5 and < 37.5) and mild hypothermia (>32 and <35). Surface cooling is initiated within CICU for the management of some patients, as per indications above.

Continuous core temperature monitoring is essential for patients when having targeted temperature control to enable machine titration or response in a timely manner.

For children with severe traumatic brain injury, fever is considered a secondary brain injury. Guided surface cooling to therapeutic normothermia or mild hypothermia can be used to reduce the risk of secondary brain injury. Secondary brain injury can lead to increased cell death and poor neurological outcomes. Reduction in temperature of the brain reduces cerebral blood flow and metabolism and therefore reduces intra-cranial pressure.

Methods of surface cooling:

- Create heat loss through convection and evaporation, removing patient covers, and allowing exposure to ambient air.
- Minimise heat production by limiting anxiety and/or movement (i.e. administering sedation and/or pain relief).
- Institute measures, progressively and individually, to reduce temperature - from least to most stimulating/invasive until an effect produced.
- Initiate the Arctic sun using the automatic therapy mode.
- Consider environmental warming during TCC. The use of a bear hugger over the top of the patient to control shivering may reduce the need for heavy sedation or muscle relaxation.
- If shivering occurs cessation of cooling measures, or commencement of muscle relaxation will occur in consultation with medical officer and be documented by the medical officer. Refer to [Neuromuscular Blockade Agents Policy and Peripheral Nerve Stimulator \(Train of Four\) Monitoring In CICU - SCH](#)

5 Procedure

5.1 Cooling of Patients

Institute the following progressively until goal is achieved:

1. Expose patient's trunk, thighs and arms to room air.
2. Administer antipyretic drugs such as paracetamol if appropriate for the patient.
3. Sedate the patient. Arctic Sun cooling pads may be applied to the sedated patient.

4. If intubated and ventilated, muscle relaxation itself might help reduce the temperature without the need to use the cooling pads. Furthermore, if used in conjunction with the cooling pads muscle relaxation may decrease metabolic demand by inhibiting the patient from shivering.

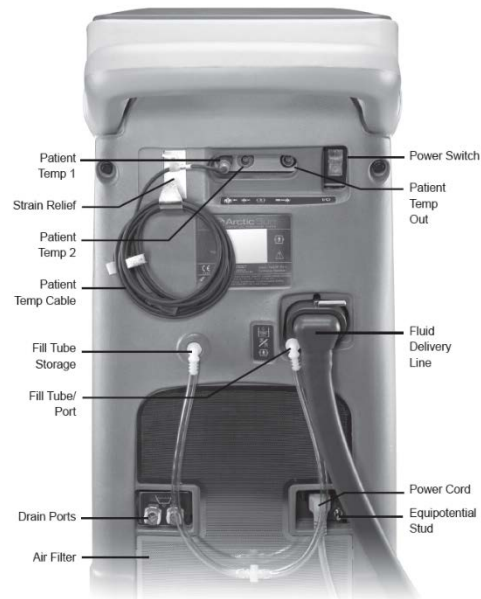
5.2 Use of the Arctic Sun System

Preparation

- Select the correct size pads for the patient:
 - 0-5kg = neonatal pad
 - 6-15kg = neonatal pad + universal pad
 - 16-30kg = XX small pad
 - 31-45kg = X small pad
 - 46-60kg = small pad
 - 61-75kg = medium pad
 - 76-100kg = large pad
- **Neonatal pad**
 - lay the baby on the pad. Do not remove the white mesh, fasten the abdominal straps (avoiding the axillary area). Leave nappy on.
- **All other Pads**
 - Apply the 4 gel pads (2x Torso and 2x Thigh)
 - peel the backing off
 - ensure groin access remains free when placing the thigh pads
 - Place the torso pads 2cm from the spine and wrap around underneath the axilla and breast line
 - ensure a snug fit that is not too tight. You might need to loosen if the patient becomes oedematous
 - Aim for coverage of 40% of body. A universal pad may be applied if needed.

Pads are x-ray, MRI and CT safe. They can also be used during CPR, defibrillation pads can be placed underneath the gel pads.

Set up



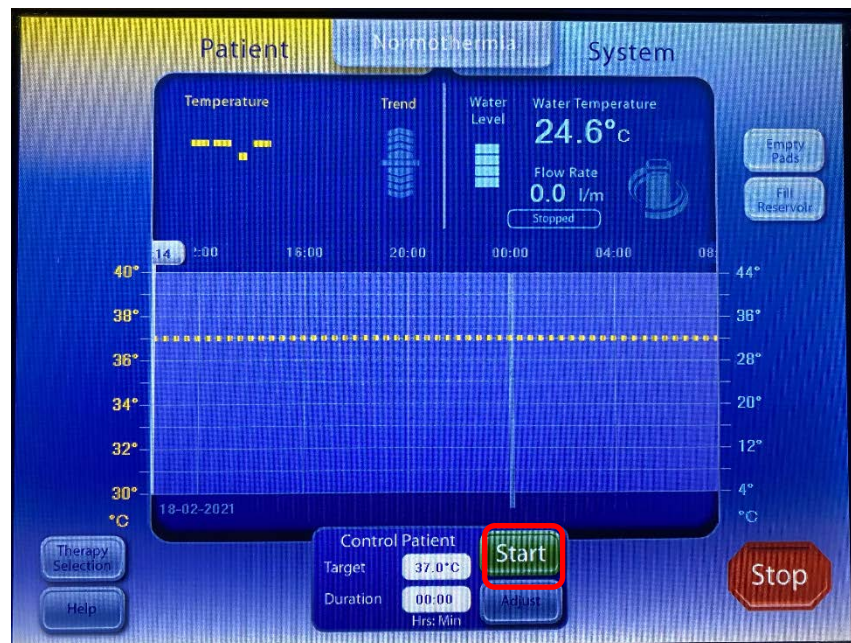
- Ensure that the water reservoir is full prior to any treatment. Water can remain in the system for 6 months – do not drain the machine. The total reservoir holds 3.5L of sterile water. Please inform CICU Equipment Coordinator if the water is due for changing.
- Place core temperature probe, ensuring that it is the appropriate position e.g. the oesophageal probe is in the lower third of the oesophagus. Refer to point 3 Temperature Monitoring.
- Connect to the arctic sun machine, the patient's temperature will be displayed on the screen.
- Ensure you have the correct size cooling pads for the patient (refer to point 5.2). Apply the cooling pads to the appropriate areas on the patient's body. Pads should be replaced every 5 days. Avoid leaving soaps, moisturisers or powder underneath gel pads
- Connect the pads to the fluid delivery lines on the machine. Ensure that the connections are secure to prevent leakage once the pads commence filling.
- The Manual mode is not recommended for long periods of time and as such it is advised to use the automatic therapy modes.
- Select "**Normothermia mode**" for indications such as TBI, Sepsis or other neurological concerns (except HIE in babies and sudden cardiac arrest patients).
- Select "**Hypothermia mode**" for Sudden Cardiac Arrest patients and babies with HIE in which protocols are preprogrammed



- Once the setting has been chosen, targeted temperatures can be adjusted by pressing the 'adjust' button.

N.B In the “hypothermia” setting ‘cool patient to’ and ‘cool patient for’ can be selected.

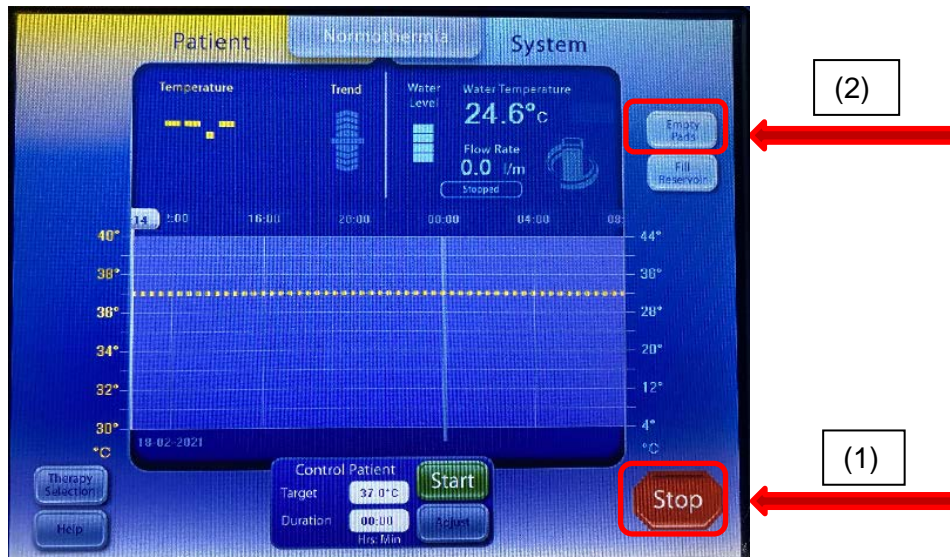
- Set initial desired temperature for the patient using the 'Adjust' soft key. This may initially be higher than normothermia to avoid too rapid cooling.
- Select 'Start'. The pads will start to fill with water prior to treatment commencing.



In Automatic mode, the Arctic Sun will regulate the water temperature to maintain the set desired patient temperature.

Ceasing treatment

- Select red 'Stop' soft key (1).
- Select 'Empty Pads' soft key (2) and follow instructions. Ensure that the emptying is complete before disconnecting the tubing from the pads.



- Remove pads from the patient as soon as appropriate.
- Disconnect temperature probe from the machine and remove probe if continuous temperature monitoring no longer required.

The machine will continue to monitor the patient's temperature if the temperature probe remains insitu and connected.

5.3 Re-warming Phase – Returning the Patient's Core Temperature to Normothermia

****This treatment may be required for hypothermic patients post drowning ****

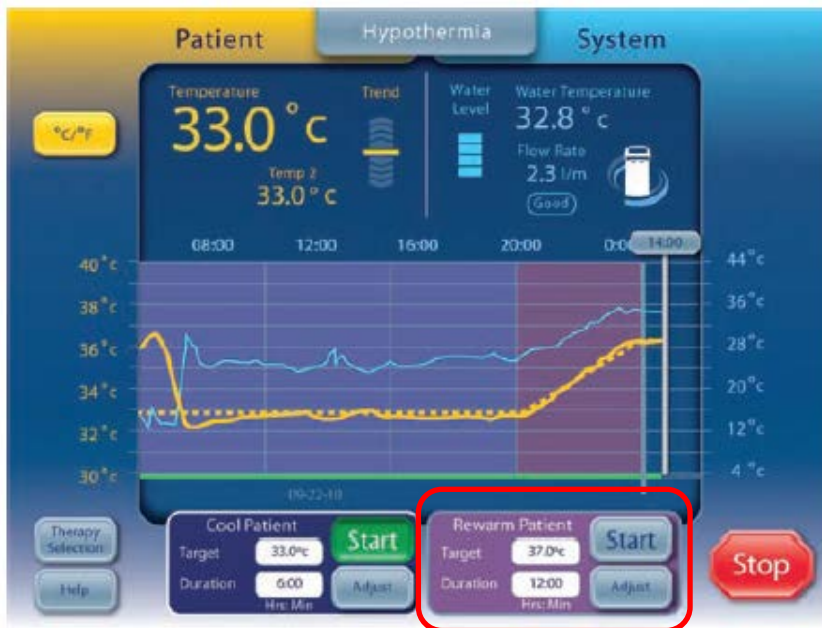
This phase aims to return the patient to stable normothermia whilst avoiding rebound hyperthermia and/or hypotension.

During re-warming the patient will vasodilate, during which the shift of cooler blood from the core to the extremities as they warm can lead to after-drop in temperature and hypotension. They may require the commencement of or adjustment of inotropic infusions.

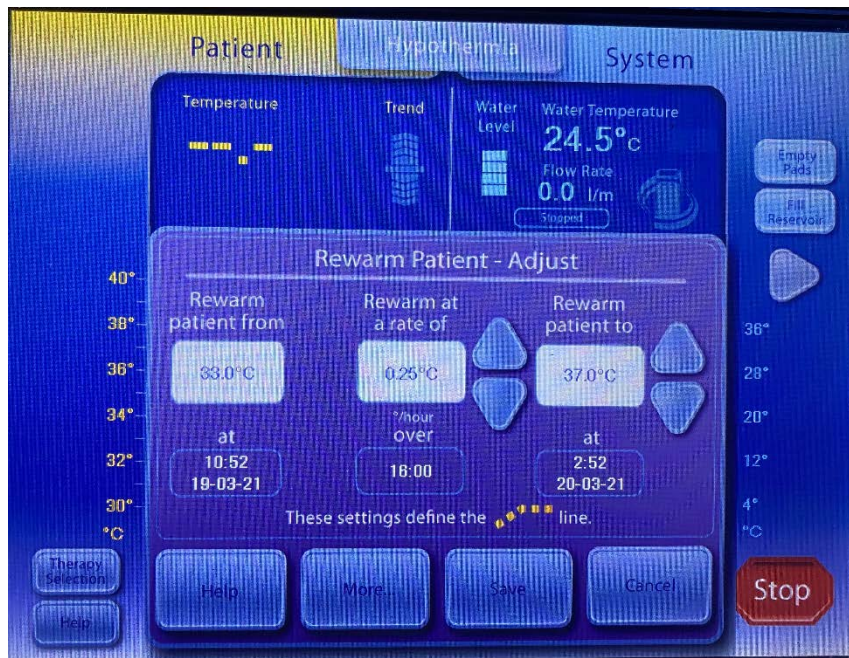
Rewarming will be directed by the Intensivist or CICU Fellow.

- Consider volume loading the child before re-warming begins to avoid hypotension. Monitor during rewarming, administer fluid bolus if required.

- Select Hypothermia mode. Press 'Adjust' in the Rewarm Patient option.



- In the adjust window you can insert the current patient temperature in the 'rewarm patient from' box, select the rewarm rate – as per Intensivist and indicate the desired temperature to rewarm the patient to.



- Select Save.
- Select start in Rewarm patient window.

5.3.1 Maintaining Temperature – for the patient following brain death considered for organ donation.

- Set rewarm target temperature 36 – 36.5 degrees.
- Arctic sun will slowly warm the water in the pads to increase core temperature if patient temperature below 36 degrees.
- Use warm blankets if required.
- Document patient temperature hourly.

References

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