

GUIDELINE FOR TARGETED TEMPERATURE MANAGEMENT & USE OF BLANKETROL III COOLING BLANKET

Definition

Targeted Temperature Management (TTM) refers to artificially induced and maintained normothermia for TBI and HIE as a neuro protective strategy.

Hypothermia can also be used as a Tier 1 intervention for intractable raised ICP

Clinical Application¹

1. Severe Traumatic Brain Injury (TBI) 36-37 °C for 72 hours
2. Hypoxic Ischaemic Encephalopathy (HIE) 36 °C for 36 hours then 36.5 until 72 hours post arrest

Actively cool to prevent temperature spikes above 37.5 °C

Traumatic Brain Injury

While there is little evidence that moderate hypothermia (32-33°C) leads to an improved neurological outcome for children with a TBI it is well established that *fever* contributes to a worse outcome.

Children with a severe TBI are maintained at normothermia (36-37°C) for at least 72 hours.

Blanketrol Set Point is 36.5 °C

Hypothermia as a Tier 1 Treatment for Raised ICP

Hypothermia can be used to manage raised ICP (see Tier 1 treatment of raised ICP in TBI protocol).

Children requiring cooling for ICP control: Blanketrol Set Point is set at desired core temperature, for example 35.5 °C.

Temperature is seldom required to be below 35 °C

Hypoxic Ischaemic Encephalopathy (HIE)

Ongoing injury can occur for several days after the initial insult. There are many mechanisms by which this occurs and all are made worse by fever.

***Children with HIE are maintained at 36 °C for 36 hours.
Blanketrol Set Point is 36 °C for first 36 hours then 36.5 °C until 72 hours post injury/arrest***

Shivering

Shivering is part of a vigorous thermoregulatory defence to maintain temperature at a hypothalamic set point, (Badjatia, 2012).

Shivering causes metabolic and haemodynamic stress.³

***Before cooling ensure children are heavily sedated and muscle relaxed. Observe closely for 'goosebumps' and shivering.
See PICU Sedation & analgesia protocol
Use Morphine and Midazolam infusions to maintain deep sedation and analgesia***

Phases of Targeted Temperature Management using Blanketrol III.

1. Induction
2. Maintenance
3. Rewarming

Phase 1: Induction

1. Place child on gel cooling blanket. A second disposable cooling blanket can be used on top of the child to speed cooling and reduce temperature fluctuation.
2. Ensure child is deeply sedated and muscle relaxed.
3. Insert **oesophageal** temperature probe and connect to machine. May also use **IDC** with temperature thermistor.
4. **Do not use a rectal temperature probe when using Blanketrol.**
5. Check water level in machine reservoir and turn on using **Auto Control Mode**.
6. Programme Set Point, 36.5 °C for TBI
36.0 °C for HIE
7. Blanketrol will fill the blanket(s) and start water circulation.
8. Conductive energy transfer will cool patient to target temperature.

Phase 2: Maintenance

1. When patient temperature reaches 0.5 °C of Set Point press **Gradient 10C** and the **Smart** key.
2. Blanketrol will continue to regulate water temperature to maintain patient within target range.
3. If patient temp is out of range consider going back to Induction phase until within 0.5 °C of set point as in Maintenance step 1.

Phase 3: Rewarming

Rewarm no faster than 1 °C every six hours.

1. Increase target Set Point by 0.2 °C every hour until target temperature reached
2. Use **Gradient 10C + Smart** and continue to monitor temperature closely

Labelled Blanketrol III Interface**Notes**

TTM can also be used to manage refractory fever causing clinical compromise. Degree of cooling is individualised and prescribed by PICU medical staff.

The hypothalamus maintains core temperature between 36 - 37 °C. Rectal & jugular venous temp are thought to be 1.1°C lower than mean **brain** temperature following brain injury, Rumana et al (1997).

Shivering can increase the basal metabolic rate by 5 times normal causing increased demand for oxygen and nutrients, increased production of CO² and increased energy expenditure. Haemodynamic changes include increased heart rate, BP and ICP.

Blanketrol III Modes of Operation

In the automatic modes the blanket operation is based upon the patient temperature rather than the circulating water temperature (manual mode). Always use a temperature probe and an automatic mode.

The main modes are:

Auto Control Mode

The *Blanketrol* compares the patient's measured temperature to the specified Set Point. The water temperature cools or heats to maximum allowable, 4 - 42 °C, until patient temperature adjusts to Set Point. There is the potential to overshoot the desired patient temperature at each end of the range.

Gradient 10C Mode

As in Auto mode the unit compares the patient's temperature to the specified Set Point. The water temperature in the blanket adjusts to a maximum of 10 °C either side of the patient's measured temperature so there is less chance of overshooting the desired temperature but it can take longer to bring the patient back to Set Point.

Smart Mode

The unit compares the patient's temperature to the specified Set Point. Every 30 minutes the water temperature adjusts by -5 °C or +5 °C depending on whether the unit is heating or cooling the patient. As in Auto mode the water temperature can range between 4 - 42 °C.

Gradient 10C + Smart

The blanket water temperature adjusts to a maximum of 10 °C but every thirty minutes the water temperature will adjust by another 5 °C to bring child to Set Point. This will be the main mode used to maintain a child's temperature in PICU.

Gradient Variable Mode

Operates the same way as Gradient 10C mode except the nurse can programme the temperature difference between the patient temperature and the water temperature. For example the nurse could adjust the water temperature to be only 8 °C either side of the patient temperature. Seldom used in PICU.

Monitor Only Mode

The unit monitors and displays the patient temperature. The *Blanketrol* does not heat, cool or circulate the water in the blanket. This mode is not recommended while actively cooling to normothermia but could be used once child has rewarmed and is being observed prior to discontinuing the use of the cooling blanket.