Keeping it cool – targeted temperature management in the out of hospital cardiac arrest.

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Disclosure

This session is supported and sponsored by Stryker UK.

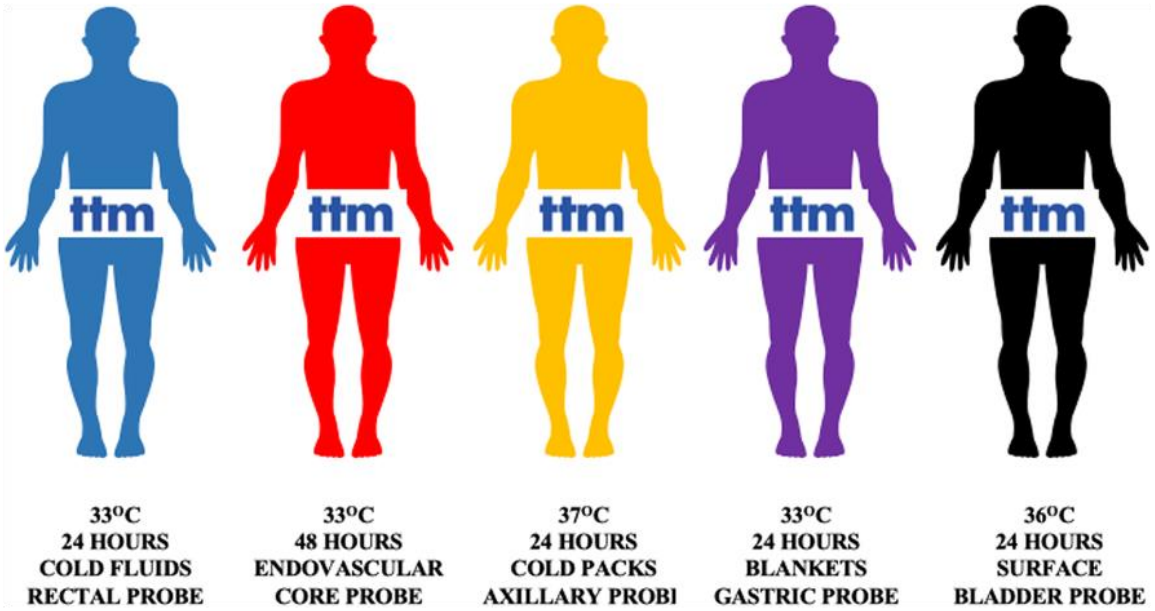
I have received payment for delivering this session but have had control over the content of the presentation.

Learning objectives

- To understand the role of targeted temperature management in out of hospital cardiac arrest (OOHCA) patients in improving neurological outcome.
- To understand the history of the therapy
- To provide an overview of the TTM1 and TTM2 studies and conclusions with implications for practice.
- Understand how to use technology to achieve the desired clinical outcomes.
- How to manage shivering effectively.
- How to trouble shoot TTM and mitigate potential complications in practice
- To use a case study to summarise and allow practical application of learning.

The Numbers

- The incidence of out-of-hospital cardiac arrest (OOHCA) in the UK is approximately 60,000 per year and UK ambulance services attempt resuscitation in an estimated 30,000 people per year (NECPOD 2021)
- Fewer than 1 in 10 patients survive a OOHCA in the UK (NECPOD 2021)
- The quicker we recognised, respond, CPR and defib the better outcome (Resus UK 2021)
- UK does poorly in comparison to other countries in the world.



What is targeted temperature management?

The control of a temperature inside a certain parameter using a positive feedback loop device for a period of 72 hour following cardiac arrest.

Why?

- Return of spontaneous circulation leads to a cascade of events called 'reperfusion injury', leading to brain injury.
- Reperfusion causes a massive increase in the production of free radicals such as hydrogen peroxide, superoxide, nitric oxide, and hydroxyl radicals. This overwhelms to protective antioxidant mechanisms throughout the body and causes the peroxidation of lipids, proteins, and nucleic acids, which contribute to neuronal damage.
- Reperfusion leads to a SIRs response, increasing temperature.
- A hot brain, with high metabolic rate and high free radicals leads to profuse neuroal death (cell death).
- Hypothermia suppresses the inflammatory cascade and, in turn, prevents the exacerbation of cerebral injury by inflammation.

The NEW ENGLAND JOURNAL of MEDICINE

ORIGINAL ARTICLE

Targeted Temperature Management at 33°C versus 36°C after Cardiac Arrest

CONCLUSIONS

In unconscious survivors of out-of-hospital cardiac arrest of presumed cardiac cause, hypothermia at a targeted temperature of 33°C did not confer a benefit as compared with a targeted temperature of 36°C. (Funded by the Swedish Heart–Lung Foundation and others; TTM ClinicalTrials.gov number, NCT01020916.)

Nielsen N, Wetterslev J, Cronberg T, Erlinge D, Gasche Y, Hassager C, Horn J, Hovdenes J, Kjaergaard J, Kuiper M, Pellis T, Stammet P, Wanscher M, Wise MP, Åneman A, Al-Subaie N, Boesgaard S, Bro-Jeppesen J, Brunetti I, Bugge JF, Hingston CD, Juffermans NP, Koopmans M, Køber L, Langørgen J, Lilja G, Møller JE, Rundgren M, Rylander C, Smid O, Werer C, Winkel P, Friberg H; TTM Trial Investigators. Targeted temperature management at 33°C versus 36°C after cardiac arrest. N Engl J Med. 2013 Dec 5;369(23):2197-206. doi: 10.1056/NEJMoa1310519. Epub 2013 Nov 17. PMID: 24237006.

High quality multi centred, international RTC looking at the neurological outcomes of patients at 33c or 36c post OOHCA

Pre published protocol and active feedback and listen.

929 patient recruited, largest trail in the area when published.

The NEW ENGLAND JOURNAL of MEDICINE

ORIGINAL ARTICLE

Hypothermia versus Normothermia after Out-of-Hospital Cardiac Arrest

J. Dankiewicz, T. Cronberg, G. Lilja, J.C. Jakobsen, H. Levin, S. Ullén, C. Rylander, M.P. Wise, M. Oddo, A. Cariou, J. Bělohlávek, J. Hovdenes, M. Saxena, H. Kirkegaard, P.J. Young, P. Pelosi, C. Storm, F.S. Taccone, M. Joannidis, C. Callaway, G.M. Eastwood, M.P.G. Morgan, P. Nordberg, D. Erlinge, A.D. Nichol, M.S. Chew, J. Hollenberg, M. Thomas, J. Bewley, K. Sweet, A.M. Grejs, S. Christensen, M. Haenggi, A. Levis, A. Lundin, J. Düring, S. Schmidbauer, T.R. Keeble, G.V. Karamasis, C. Schrag, E. Faessler, O. Smid, M. Otáhal, M. Maggiorini, P.D. Wendel Garcia, P. Jaubert, J.M. Cole, M. Solar, O. Borgquist, C. Leithner, S. Abed-Maillard, L. Navarra, M. Annborn, J. Undén, I. Brunetti, A. Awad, P. McGuigan, R. Bjørkholt Olsen, T. Cassina, P. Vignon, H. Langeland, T. Lange, H. Friberg, and N. Nielsen, for the TTM2 Trial Investigators*

CONCLUSIONS

In patients with coma after out-of-hospital cardiac arrest, targeted hypothermia did not lead to a lower incidence of death by 6 months than targeted normothermia. (Funded by the Swedish Research Council and others; TTM2 ClinicalTrials.gov number, NCT02908308.)

High quality multi centred, international RTC following on from TTM1

Looking at the difference between 33c and fever prevention (<37.8c)

Pre published protocol and active feedback and listen.

1850 patient recruited, huge trail.

Control is still important; it just doesn't matter what temperature.

Arrhythmias resulting in hemodynamic compromise were more common in the hypothermia group than in the normothermia group (in 24% vs. 17%; P<0.001

Resuscitation Council UK

Guidelines: Post-resuscitation care

TTM for all OOHCA with neurological deficient at ROSC.

Control at 36c (less risk of complications with 36c).

Minimum of 24 hours with fever prevention for 72 hours.

NCEPOD

Time Matters

A review of the quality of care provided to patients aged 16 years and over who were admitted to hospital following an out-of-hospital cardiac arrest

A report published by the National Confidential Enquiry into Patient Outcome and Death (2021)

Where an answer was provided, there were 67/137 (48.9%) hospitals from which it was reported that a device which used a ‘feedback loop’ was available (Table 6.14).

It was notable that for 158/699 (22.6%) patients, the clinician completing the questionnaire did not know if such a policy was in place in their hospital?

In the case notes that were peer reviewed, TTM was not indicated in 114/403 (28.3%) patients (Figure 6.5). In the remaining 289 patients, TTM was used in 131/289 (45.3%).

NCEPOD

Time Matters

A review of the quality of care provided to patients aged 16 years and over who were admitted to hospital following an out-of-hospital cardiac arrest

A report published by the National Confidential Enquiry into Patient Outcome and Death (2021)

4. Targeted temperature management Elevated temperature is common following an OHCA and is associated with a worse prognosis, but this can be improved by accurate, active temperature control. The current approach in clinical practice appears to be inconsistent and a more active approach is needed.

But its new?

- 1803 – Russians use Snow to achieve ROSC
- 1812 – Cooled injured limbs to reduce pain and save them
- 1952 – Rosomoff and Holaday found a reduction in cerebral oxygen consumption in a cohort of cooled dogs
- 1955 – same people found a correlation between core temperature, ICP and brain volume

TTM – Inclusion criteria

- Witnessed In-Hospital or out-of-hospital arrest or VT/ VF initial rhythm
- Age 18-75 years
- ROSC – Arrest interval ≤ 60 minutes
- Systolic BP ≥90 mmHg or MAP ≥ 50 mmHg with ≤ 2 pressor
- Comatose (GCS < 10)
  - Not following/responding to verbal commands
  - No withdrawal from painful stimuli
- Ability to initiate cooling within 4 hrs of arrest

How?

- Intravascular
- Intra nasal
- Cutaneous

Whatever you use it MUST be a positive feedback device that responses to the temp of the patient.

Managing complications

- Shivering
- Tissue viability
- Line infection
- Accurate temperatures bladder vs oesophagus
- Early cessation
- BSA coverage
- K+ shifts
- Rewarming if selecting 33c
- Cardiac arrythmia if selecting 33c

Shivering – your menace

Score	Shivering	Patient Behavior
0	None	No shivering
1	Mild	Shivering localized to the neck/thorax, may be seen only as an artifact on ECG or felt by palpation
2	Moderate	Intermittent involvement of the upper extremities ± thorax
3	Severe	Generalized shivering or sustained upper/lower-extremity shivering

- 40% of patients on TTM will shiver (Jian, 2018)
- Pick your assessment tool, Bedside shivering assessment tool (BSAT)

Shivering Management

- Cutaneous counter warming – only can be used if internally cooling (Badjatia, 2009) Warming just hands might help
- Electroacupuncture – most units doing have the technology
- Antipyretic agents, including paracetamol , aspirin, and NSAIDs - might not work in patient with injury to hypothalamus
- Intravenous magnesium sulphate (serum level target, 3–4 mg/dL) - increases cooling rate and reduces shivering by dilating smooth muscle
- Opioid analgesics
- α-Agonists - Dexmedetomidine/ clonidine reduce threshold but Dexmedetomidine may induce brady cardia
- Anaesthetics and Sedatives – prop is the best
- Serotonin (5-HT) Agonists/Antagonists - ondansetron/ tramadol
- NMDA Antagonists – ketamine
- Neuro-Musculo blockade – should be used as a last line of treatment.

Clinical case study?

- 64 YO male.
- PMH – T2DM, Obesity (BMI 38), IHA, HTN, Previous TIA's x 2.
- Witnessed collapse at a ruby match - Bystander CPR within 3 mins.
- VT – 3 x shock by on site AED + 1 x shock by ambulance crew (in CA for 35 mins).
- ROSC.
- In ED – insufficient breathing, GCS 5 (E1 V1 M3) – RSI.
- Admit to ITU for post ROSC care.

Any questions?

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@robfub

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