Targeted Temperature Management (TTM) for Comatose Survivors of Cardiac Arrest

Introduction

Cardiac arrest both in and outside of the hospital has a poor outcome. Historically survival rates range from 5% to 48%. In 2013 UHB had an overall survival to hospital discharge following cardiac arrest in or outside of the hospital of 14%, this is typical of most UK hospitals but far behind what is currently being achieved in leading centres.

At the time of cardiac arrest there is a reduction in cranial blood flow and accumulation of metabolites resulting in a hypoxic ischaemic brain injury. It is thought that this is a significant contributory factor to the overall poor outcome for this patient group.

Animal data has long supported the concept of managing temperature by inducing hypothermia following cardiac arrest to improve neurological outcome. In 2002 two landmark trials were published in the New England Journal of Medicine (NEJM); A European multicentre trial with a total of 136 patients compared therapeutic hypothermia of 32-34 for 24 hours to normothermia and demonstrated 55% vs 39% favourable neurological outcome and a six month mortality of 41% vs 55% both favouring the hypothermia group, and a further Australian trial of 77 patients demonstrated a 49% vs 26% survival or good outcome using a similar target temperature for 12 hours. Both of these studies were of out of hospital cardiac arrests with ventricular fibrillation as the presenting rhythm. In the decade since there publication therapeutic hypothermia has been recommended by multiple national and international resuscitation groups and has become a standard of care for all comatose survivors of non-traumatic cardiac arrest.

Current debate centres around the target temperature and the duration of cooling. A recent paper again from the NEJM has provided some insight into this area. In this international randomised multicentre trial of 950 patients targeting 33 vs 36 degrees for 28 hours was compared and their was no statically significant difference between the groups.

This trial had an overall survival rate of 48% in both groups, higher than in the previous published trial arms without any targeted temperature management.
The Guidelines

The guidelines are taken from the 36 degree arm of the above referenced paper with slight modifications to suit local practice.

The guidelines are for comatose survivors of non-traumatic cardiac arrest as traumatic cardiac arrests were excluded from the trials.

The first priority is the universal life support algorithm as created by the UK resuscitation council.

Upon return of spontaneous circulation (ROSC) the patient may or may not fully regain consciousness.

For the purpose of these guidelines any patient who does not regain a sufficient level of consciousness to protect there airway OR whom are neurologically inappropriate such that they require anaesthesia and ventilation to facilitate their care are said to be comatose.

All other patients are non-comatose and thus do not require this therapy.

For patients inside critical care the placement of a thermoguard catheter and commencement of temperature control should begin with 1 hour. The NEJM TTM trial cooled ‘as quickly as possible’. For patients already in the critical care unit it should be possible to begin TTM within 1 hour.

For those patients who have a cardiac arrest in a non-critical care area they should have a core temperature checked and if over 36 degrees Emcool pads should be applied to cool to below this temperature.

If accepted by critical care they should be transferred to critical care and the placement of a thermoguard catheter and commencement of temperature control should begin with 4 hours.

The 4 hour period is chosen based on the manufactures recommendation of the effective cooling period of the Emcool pad system and the potential time for transfer to critical care allowing time for cardiology input if required.

The maintenance of 36 degrees for 24 hours is based on the trial protocol, in the original trial 28 hours was used. We have shortened this period to 24 hours as the nursing staff felt that this improved logistics and would result in an overall improved application of the guideline. Various durations of cooling between 12 and 28 hours have all shown benefit and practicalities of implantation must be carefully considered for the technique to be effective.
The rates of rewarming and the maintenance of 37 degrees for a total of 72 hours post arrest are based on the trial protocol.

The thermoguard catheter is only licensed for 3 days use and thus must be removed following provision of 72 hours TTM therapy
Equipment selection

A working group compromised of representatives from emergency medicine, the resuscitation department and intensive care was established and a needs assessment was performed.

There is a need for areas outside critical care to be able to perform rapid, easy, non-invasive and effective cooling whilst the critical care component of this therapy required the ability for very precise temperature control for a 72 hour period.

The eight market leading technologies were reviewed by this group and ultimately based on stakeholder feedback the Emcool Pad based system and the thermoguard catheter system were selected for use out of, and inside, critical care respectively.

The emergency department was felt to be a good central location for the Emcool Pads to be stored as this is where about 50% of the candidate patients group arrive and it also provides a known fixed location for the ward based resuscitation teams to access.

Audit targets

1) 100% of comatose survivors of non-traumatic cardiac arrest selected for TTM by a critical care consultant should receive TTM.

2) 100% of comatose survivors of non-traumatic cardiac arrest outside critical care with a temperature over 36 degrees should have Emcool Pads applied

3) 100% of comatose survivors of non-traumatic cardiac arrest selected for TTM by a critical care consultant having a cardiac arrest within critical care should commence TTM via the thermoguard system within 1 hour of ROSC

4) 100% of comatose survivors of non-traumatic cardiac arrest having a cardiac arrest outside critical care should commence TTM via the thermoguard system within 4 hour of ROSC

5) 100% of thermoguard catheters must be removed on day 3 following insertion.
References:


4) Targeted Temperature Management at 33°C versus 36°C after Cardiac Arrest. TTM Trial Investigators. NEJM 2013. DOI:10.1056/NEJMoa1310519


Targeted Temperature Management (TTM) Guidelines for Comatose Survivors of Non-Traumatic Cardiac Arrest

(These guidelines are to be used to support the provision of TTM in conjunction with all post resuscitation care both in and out of the critical care environment including intubation, ventilation, consideration of cardiological intervention and treatment of underlying cause of arrest)

Non-Traumatic Cardiac Arrest

Advanced Life Support Algorithm with Return of Spontaneous Circulation (ROSC)

COMATOSE (not comatose = not for TTM)
(GCS < 8 post arrest or required intubation and ventilatory support before fully regaining GCS 15 post arrest for any reason)

Already in Critical Care

Outside Critical Care

Ensure body temperature < 36 °C Target within 1 hour of ROSC
apply Emcool pads if required (located in A&E freezer)

Refer to critical care
If accepted transfer to critical care
(Cardiology intervention if required pre-critical care)
Site Thermoguard catheter upon arrival in critical care (Target within fours hours of ROSC)

Immediately commence TTM with a target core temperature of 36°C for 24 hours.
(Maintain sedation +/- paralysis during this period)
(Please see Thermoguard instructions for set-up and running guidance)

After 24 hours rewarm to 37°C at a rate of 0.5°C per hour.

Maintain at 37°C until patient is 72 hours post ROSC
(Sedation may be held when normal body temperature is reached at clinician discretion)

Remove Thermoguard catheter at 72 hours post insertion; insert alternative central access if required.