Liverpool Heart and Chest Hospital NHS
NHS Foundation Trust

Reference Number: FOI/2020/261
From: Commercial

Date: 22 September 2020

Subject: Management of out-of-hospital cardiac arrest, in-hospital cardiac arrest, and targeted temperature management following sudden cardiac arrest

Q1 Can you please describe what guidelines are currently used in Liverpool Heart And Chest Hospital NHS Foundation Trust for the management of OHCA and IHCA? Please attach a copy of Trust's protocols for the management of OHCA.

A1 Please see attached for policies:-

- Targeted Temperature Management CMCCN
- Usual care for Primary PCI and OOHA patients returned v1.0

Q2 Has Liverpool Heart And Chest Hospital NHS Foundation Trust incorporated the European Resuscitation Council Guidelines for Resuscitation 2015 into Trust's post cardiac arrest care protocols?

A2 The Trust follow the Resuscitation Council UK guidelines 2015 for post cardiac arrest management.

Q3 Can you please confirm if TTM is incorporated as part of the OHCA management in Liverpool Heart And Chest Hospital NHS Foundation Trust? If yes, can you please confirm:

A. What is the target temperature?
B. What method or equipment is currently used to ensure that the target temperature is achieved and maintained?
C. Which staff members are currently responsible for delivering TTM as part of OHCA management?
D. What proportion of OHCA that arrive at Liverpool Heart And Chest Hospital NHS Foundation Trust that receive TTM

A3 Yes, TTM is incorporated as part of the OHCA management at LHCH.

A. 36 C
B. Arctic Sun, a surface cooling system.
C. Critical care nursing staff are trained to deliver this.
D. All suitable patients unless they meet exclusion criteria.

Q4 Can you confirm whether TTM is part of the OHCA training curriculum for the members of the resuscitation and advanced life support team and critical care team at Liverpool Heart And Chest Hospital NHS Foundation Trust? Please include any relevant training materials and checklist currently in use.

A4 Yes. TTM is discussed on Resuscitation Council UK approved ILS courses and ALS courses that the trust provides, which is mandatory for all nursing staff and cardiac arrest team members respectively.

Q5 Please provide data on outcomes for patients who had suffered OHCA and have been treated in Liverpool Heart And Chest Hospital NHS Foundation Trust. Can you please tell us the number of patients who suffered OHCA and were admitted to Liverpool Heart And Chest Hospital NHS Foundation Trust for the period from 2014 to 2019 (please include yearly breakdown where available) that:

A. Have resulted in a poor outcome, such as severe neurological disability, persistent vegetative state or death (CPC scores 3, 4, or 5);
B. Have been discharged with a good neurological outcome (CPC 1 or 2).

A5 Please see below for a table of results for 2014 -2019 with outcome Death / Alive status on discharge:

Year	Arrested at Scene	Arrested in Ambulance	Ventilated prior to LHCH Arrival	OHCA - Alive	OHCA - Death
2014 (Total: 161)	19	56	35	126	35
2015 (Total: 171)	30	71	61	139	32
2016 (Total: 150)	37	38	58	120	30
2017 (Total: 215)	109	16	85	166	49
2018 (Total: 219)	131	21	92	181	38
2019 (Total: 150)	86	20	57	121	29

A. Information exempt under Section 21 of the Freedom of Information Act 2000 - 'Information reasonably accessible to the applicant by other means'.

   This information is published by the Association of Ambulance Chief Executives and can be found here: https://aace.org.uk/wp-content/uploads/2018/05/Out-of-Hospital-Cardiac-Arrest-Outcomes-OHCAO-Registry-57904-CTU-Report-final.pdf

   This information is published by NHS England and is available here: https://www.england.nhs.uk/statistics/statistical-work-areas/ambulance-quality-indicators/

B. Please see answer 5A above.

Targeted Temperature Management (TTM) following Out of Hospital Cardiac Arrest (OHCA)

Introduction

Therapeutic hypothermia has been shown to improve outcome following cardiac arrest in two major randomised controlled trials[1,2]. This led to initial recommendations that unconscious adult patients should be cooled to 32-34ºC for 12-24 hours when the initial rhythm was Ventricular Fibrillation (VF), and that cooling may be beneficial for other rhythms or in-hospital arrest[3].

However, recent trials cast some doubt on the validity of aggressive early cooling, demonstrating that maintaining core target temperature at 36ºC may be sufficient to facilitate neurological recovery.

In the Targeted Temperature Management (TTM) trial, 950 all-rhythm OHCA patients were randomised to 36 h of temperature control (comprising 28 h at the target temperature followed by slow rewarm) at either 33°C or 36°C[4]. There was no difference in mortality and detailed neurological outcome at 6 months was also similar. Importantly, patients in both arms of this trial had their temperature well controlled so that fever was prevented in both groups.

The term targeted temperature management or temperature control is now preferred over the previous term therapeutic hypothermia.

The Advanced Life Support Task Force of the International Liaison Committee on Resuscitation (ILCOR) made several treatment recommendations on targeted temperature management [5]:

N Main, T Mahambrey, J Ratnasingham

- Maintain a constant, target temperature between 32°C and 36°C for those patients in whom temperature control is used.
- TTM is recommended for adults after OHCA with an initial shockable rhythm who remain unresponsive after ROSC.

Following the TTM trial, many intensive care clinicians in the UK have elected to use 36°C as the target temperature for post cardiac arrest temperature control. This has several advantages compared with a target temperature of 33°C:

- There is a reduced need for vasopressor support.
- The rewarming phase is shorter.
- There is reduced risk of rebound hyperthermia after rewarming.

These guidelines are based on the current evidence and protocols from individual trusts in Cheshire and Merseyside; we have opted for a target temperature of 34-36°C.

These guidelines are to be used at the discretion of the attending clinician.

Inclusion Criteria

- VF cardiac arrest with return of spontaneous circulation (ROSC)
- Asystole and PEA may be considered
- Persistent coma (GCS<8)
- Endotracheal Intubation with mechanical ventilation
- Less than 15 minutes from arrest to starting CPR
- Less than 60 minutes from collapse to ROSC
- Age >18

Exclusion Criteria

- Another reason to be comatose (head trauma, stroke, status epilepticus)
- Refractory arrhythmias
- Pre-existing bleeding
- Pregnancy
- Sickle cell disease

Initiation of Targeted Temperature Management (TTM)

- Start TTM as soon as possible. However, **do not delay test or procedures to initiate cooling (e.g. Primary PCI, thrombolysis, CT scans).**
- Temperature goal 34 -36ºC as soon as achievable.
- Monitor core temperature with bladder or oesophageal temperature probe.

Protocol for Targeted Temperature Management

- Document CNS exam (include GCS, pupils and brain stem reflexes)
- Check CORE temperature (oesophageal or bladder) to continuously monitor core temperature.
- Strip patient down
- Ice packs around head, neck, axillae, and groins.
- Use ice in tied gloves and wrap in towels to prevent burns.
- Start IV sedation and analgesia as per the unit protocol.
- For units using automated cooling devices for temperature control, place cooling catheter in femoral vein and set the rate to "max cooling". set the target temperature to 34ºC.
- Give non-depolarising muscle relaxant if shivering or non compliant with ventilation. SHIVERING MUST BE ABOLISHED.

- Maintain blood glucose 4 -10mmol/l

Maintenance of Target Temperature

- Aim for core temperature 34-36ºC within 6 hours of initiating TTM.
- Aim to maintain target temperature for a period of 24 hours.
- If temperature remains above 36ºC then give 1L 0.9% NaCl (ice cold) over 30 minutes & consider regular paracetamol 1 gm IV.
- Commence maintenance fluids 0.9% NaCl at 84mls/hr.

Monitoring

- At least two sources of temperature must be used. If an electronically cooled device is being used, one thermometer should provide a continuous read out, e.g. oesophageal, urinary or blood temperature, and this should be plugged into the cooling device. A back up oesophageal thermometer should be used and recorded at 30-minute intervals. This is to avoid undetected measurement error within the device.
- Once at target hourly temperatures should be recorded for both thermometers.
- Hypokalaemia is a common disturbance in hypothermia and may be exacerbated by insulin use. Conversely, re-warming leads to potassium efflux from the cells and potentially hyperkalaemia. Check urea and electrolytes every 12 hours
- ABG's should be corrected for patient's temperature (pH stat)
- Blood cultures: Obtain at 12 hours after initiation of cooling as infection may be masked during cooling.

- STOP COOLING AND PASSIVELY REWARM if haemodynamic instability, bleeding, life threatening arrhythmia or distal limb ischaemia.

Rewarming (24 hours after target temperature is achieved)

- Passive rewarming
- **Re-warming should occur slowly at 0.25ºC per hour & recorded at 30 min intervals**
- If cooling has been conducted with a servo-control device reliant on continuous read-out from a patient thermometer, then programme in a re-warming rate of 0.25- 0.5ºC per hour to a target of 37ºC.
- **Closely monitor temperature for the next 72 hours to avoid overshoot hyperthermia. Aim to keep the temperature < 37** ºC.
- If using neuromuscular blockade stop when 36ºC reached. Stop sedation once neuro muscular blockade has worn off.
- Watch for hyper or hypoglycaemia, hyperkalaemia, hypotension and overshoot hyperpyrexia
- Consider re-instituting cooling if overshoot hyperthermia occurs.

Additional therapy

- Daily aspirin, statin and CVS medications
- Usual cardiac medications, including LMWH

Potential Complications of Induced Hypothermia

- CVS instability
- Arrhythmias

- Increased vasoconstriction
- Fluid loss from cold induced diuresis
- Electrolyte imbalance, especially hypophosphataemia, hypokalaemia, hypomagnesaemia and hypocalcaemia
- Coagulopathy
- Gastroparesis
- Sepsis & pneumonia
- Increased risk of pressure sores
- Altered pharmacokinetics and pharmacodynamics

References

1. Bernard SA, Gray TW, Buist MD, Jones BM, Silvester W, Gutteridge G, Smith K. Treatment of comatose survivors of out-of-hospital cardiac arrest with induced hypothermia. N Engl J Med. 2002, 346(8):557-63.

2. The Hypothermia after Cardiac Arrest Study Group. Mild therapeutic hypothermia to improve the neurologic outcome after cardiac arrest. N Engl J Med. 2002, 346(8):549-56

3. Nolan JP et al. Therapeutic hypothermia after cardiac arrest. An advisory statement by the Advance Life Support Task Force of the International Liaison Committee on Resuscitation. Resuscitation 2003; 57: 231-235

4. Nielsen N, Wetterslev J, Cronberg T, et al. Targeted temperature management at 33°C versus 36°C after cardiac arrest. *N Engl J Med.* 2013; 369(23):2197-206.

5. Advanced Life Support guidelines 2015. Resuscitation Council UK.

Usual care for Primary PCI and OOHA patients returned

Policy

Authors Name & Title: Nick Palmer, Clinical Lead – Intervention	
Scope: Trust Wide	**Classification: Clinical**
Replaces: New Policy	
To be read in conjunction with the following documents: N/A	
Document for public display? Yes	

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Authorised By: Medicine Divisional Governance	**Authorisation Date: 23rd March 2018**	
After this document is withdrawn from use it must be kept in archive for *the lifetime of the Trust, plus 6 years*		
Archive: Document Control		**Date added to Archive:**
Officer responsible for archive: Document Control Co-ordinator		

Has the document undergone Equality Analysis?	**Yes**
Has Endorsement been completed?	**No**

Table of Contents

Your Patient:

NAME			DOB		
Presented with: (tick those that apply)		**Angio findings:**	**Procedure undertaken: (tick,**		**Likely diagnosis:**
OOHA			None		
STEMI			POBA		
NSTEMI			PCI (stent)		
Other			Other		

Contents:

1. General Information:

These instructions are for general information only, and relate to the usual, evidence-based care of post Primary Percutaneous Coronary Intervention (PPCI) patients.

Please refer to the printed Electronic Patient Record provided by LHCH, on transfer of each patient. This document, which is completed by the Interventional cardiology consultant or registrar will contain patient-specific information regarding procedure type, access route, medications given and future management plan. All of this information will be found in documents named "PPCI (incl Rescue PCI)" or "Catheter Lab Procedure (excluding EP) – Operator".

Additional nursing and anaesthetic documentation will also accompany your patient, including a record of drugs administered during the procedure, relatives contact details and possessions. For guidance on management of radial artery closure devices please refer to the radial care instruction sheet accompanying your patient.

Please contact your local cardiologist for review and general enquiries. If not available out of hours, you can contact the on call cardiology SpR at LHCH.

2. PPCI and Critical Care Patient Pathway

PPCI patients are emergency admissions who have been transferred urgently to LHCH with a presumed acute ST elevation myocardial infarction (STEMI). They will have come directly from home via NWAS, or have been transferred from one of our regional A&E departments. Patients who are intubated and ventilated make up a small proportion of our PPCI population. Usually they are out of hospital cardiac arrest (OOHCA) survivors though some may have been intubated and ventilated pre or peri-procedurally for cardiogenic shock, LVF and respiratory failure etc. The literature suggests that outcome is poor (survival to discharge of patients presenting with VT/VF OOHA and ROSC is approx. 25% in the UK), and is often determined not by their cardiac status, but by the degree of hypoxic brain damage and the development of multi-organ failure.

It is important to appreciate that not all OOHCA survivors, or indeed all PPCI patients, will have a percutaneous coronary intervention with drug eluting stents, or plain old balloon angioplasty (POBA). In some, a decision will be made for medical therapy because no coronary obstruction is demonstrated at angiography. In a minority, with 3 vessel disease, they will need to be assessed for suitability for CABG if they recover neurologically. In others an alternative diagnosis is made – eg dilated cardiomyopathy, primary arrhythmic event, and future management may involve consideration of device therapy (ICD or CRT-D). In some patients the aetiology is considered to be non-cardiac eg sepsis, CVA, PE etc and future management will need to be tailored accordingly.

3. Usual Medications for post Myocardial Infarction/PPCI patients:

Medication will be tailored for individual patients. For example, if there is no evidence of coronary artery disease, and/or no PCI undertaken, a patient may not be prescribed antiplatelet therapy. Please refer to your patients' procedure note for further details.

1. **Antiplatelet therapy.**

Missing doses of antiplatelets significantly increases the risk of acute stent thrombosis and recurrent MI.

Dual antiplatelet therapy (DAPT) consists of:

- Aspirin 75mg once daily *AND*
- Ticagrelor 90mg twice daily
    - *OR* Clopidogrel 75mg once daily.
    - *OR* Prasugrel 10mg once daily

Most patients will be prescribed dual antiplatelet therapy with aspirin and ticagrelor, often given NG on ITU. **Patients should continue with the antiplatelet regime suggested at time of PPCI.** Please refer to patient's antiplatelet card for specific details. Do not change from ticagrelor to clopidogrel unless clinically indicated.

Note: If patients are switched from ticagrelor to clopidogrel – they should be loaded with clopidogrel 600mg 24hrs after the last ticagrelor dose before continuing with once daily dose,
75mg.

2. Glycoprotein IIbIIIa inhibitors.

These are intravenous antiplatelet agents generally used when there is residual poor coronary flow, heavy thrombus burden or suboptimal PCI result. Currently our preferred agent is Aggrastat (Tirofiban) which is usually prescribed for 12-18hrs but occasionally longer. It is to be used *in addition* to DAPT.

3. Betablockers

Betablockers should be introduced as soon as possible. Initiation may need to be delayed in the ITU patient because of suboptimal parameters, most commonly hypotension, continued requirement for inotropes or LVF. Bisoprolol is first line agent, starting dose 1.25-2.5mg once daily and then increase in increments aiming for 10mg once daily. Metoprolol (2.5-5mg IV to max of 15mg), a shorter acting betablocker, could be used as an alternative to assess response.

4. ACE Inhibitors (Ramipril)

Usual starting dose 1.25-2.5mg once daily and then increase in increments aiming for 10mg once daily. Initiation may need to be delayed in the ITU patient because of suboptimal parameters and co-existing renal failure.

5. Atorvastatin.

Usual dose 80mg nocte.

6. Other considerations

Proton pump inhibitor. Patients on critical care are likely to be at a higher risk of bleeding. Omeprazole and lansoprazole can be used in addition to the above medication.

IV diuretics are often required if evidence of pump failure.

IV amiodarone can be useful to control ventricular and supraventricular arrythmia's.

DOACs (or warfarin) may be recommended if AF, or evidence of LV thrombus.

4. Arterial Access

Details regarding the access site used for angiography and PCI can be found in the "PPCI (incl Rescue PCI)" or "Catheter Lab Procedure (excluding EP) – Operator" documents which accompany your patient.

Access is generally via the radial or femoral arteries.

Right/left radial artery access: a compression device (eg TR band) will be in situ, please refer to the radial care instruction sheet provided.

Right or left femoral artery access: generally closed by an internal Angioseal (collagen plug).

It is particularly important to assess the access sites for signs of haematoma which is

usually

clinically evident and requires manual pressure to be directly applied for a minimum of 15 mins.

Retroperitoneal bleeding may be suspected where there is abdominal pain, sudden hypotension or a significant Hb drop. A CT abdo/pelvis with contrast should be considered, and the results discussed with vascular surgeons if signs of active bleeding.

5. Imaging

Your patient will usually have had an echo pre-transfer – please refer to the procedure notes for details. If an echo has not been undertaken, this should be organised with your in house echo department within 24-48hrs.

6. Cardiology review

All patients should be referred to your local cardiology service for timely review.

7. Prognosis and Follow up

Ventilated PPCI patients, often with a preceding OOHA, have a poor prognosis. Once the cardiac condition has been stabilised, a patient's prognosis is generally determined by their cerebral recovery. Neuro prognostication is difficult, and guidelines suggest it should not be attempted until the patient is normothermic, ideally after 72hrs, by a clinician experienced in such assessments. The ICU consultant may wish to consider a neurology opinion if there is diagnostic doubt. Make prognostic decisions only after a reasonable period, as per the European Resuscitation Council Guidelines on post-arrest care.

Assuming a patient is successfully extubated, they will need step down to the cardiology service for further assessment of their LV function, consideration of device therapy (ICD, CRT-P, or CRT-D) as appropriate, and management of any residual coronary disease. Follow up will generally be arranged locally by the cardiology service. Patients requiring further revascularisation (PCI or CABG) or device therapy for heart failure will be need to be referred back to LHCH.

8. Endorsed By:-

Name of Lead Clinician/ Manager or Committee Chair	Position of Endorser or Name of Endorsing Committee	Date

9. Record of Changes

Section Number	Version Number	Date of Change	Description of Amendment	Description of Deletion	Description of Addition	Reason