IAEM Clinical Guideline

Post Cardiac Arrest Care

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In Collaboration with IAEM Clinical Guideline Development Committee

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DISCLAIMER

IAEM recognises that patients, their situations, Emergency Departments and staff all vary. These guidelines cannot cover all clinical scenarios. The ultimate responsibility for the interpretation and application of these guidelines, the use of current information and a patient's overall care and wellbeing resides with the treating clinician.
<table>
<thead>
<tr>
<th>Revision History</th>
<th>Section</th>
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<tr>
<td>Final version V1.0</td>
<td>All</td>
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# GLOSSARY OF TERMS

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Term</th>
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<tbody>
<tr>
<td>BP</td>
<td>Blood Pressure</td>
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<tr>
<td>CPC Score</td>
<td>Cerebral Performance Category Score</td>
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<tr>
<td>CPR</td>
<td>Cardiopulmonary resuscitation</td>
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<tr>
<td>CT-PA</td>
<td>Computed Tomography Pulmonary Angiogram</td>
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<tr>
<td>CT</td>
<td>Computed Tomography</td>
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<tr>
<td>DNAR</td>
<td>Do not attempt resuscitation</td>
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<tr>
<td>ECG</td>
<td>Electrocardiogram</td>
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<tr>
<td>ED</td>
<td>Emergency Department</td>
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<td>EM</td>
<td>Emergency Medicine</td>
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<tr>
<td>EMS</td>
<td>Emergency Medical Services</td>
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<tr>
<td>etCO₂</td>
<td>End-tidal Carbon Dioxide</td>
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<tr>
<td>ETT</td>
<td>Endotracheal tube</td>
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<tr>
<td>HR</td>
<td>Heart rate</td>
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<tr>
<td>kPa</td>
<td>kilopascal</td>
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<tr>
<td>MAP</td>
<td>Mean Arterial Pressure</td>
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<td>mmHg</td>
<td>Millimetres of Mercury</td>
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<tr>
<td>NIBP</td>
<td>Non-invasive Blood Pressure</td>
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<tr>
<td>NOK</td>
<td>Next of Kin</td>
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<tr>
<td>OHCA</td>
<td>Out of Hospital Cardiac Arrest</td>
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<tr>
<td>PaCO₂</td>
<td>Partial Pressure of Arterial Carbon Dioxide</td>
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<tr>
<td>PaO₂</td>
<td>Partial Pressure of Arterial Oxygen</td>
</tr>
<tr>
<td>PCI</td>
<td>Percutaneous Coronary Intervention</td>
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<tr>
<td>POCUS</td>
<td>Point of Care Ultrasound</td>
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<tr>
<td>ROSC</td>
<td>Return of Spontaneous Circulation</td>
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<tr>
<td>RSI</td>
<td>Rapid Sequence Induction</td>
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<tr>
<td>SpO₂</td>
<td>Oxygen saturation</td>
</tr>
<tr>
<td>STEMI</td>
<td>ST Segment Elevation Myocardial Infarction</td>
</tr>
<tr>
<td>VBG</td>
<td>Venous Blood Gas – Point of Care Test</td>
</tr>
<tr>
<td>OHCAR</td>
<td>Out of Hospital Cardiac Arrest Registry</td>
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POST CARDIAC ARREST CARE

INTRODUCTION

Return of Spontaneous Circulation (ROSC) is a relatively frequent presentation to the resuscitation room of Emergency Departments (EDs) in Ireland. The Out of Hospital Cardiac Arrest Registry (OHCAR) aims to collect data on every Out of Hospital Cardiac Arrest (OHCA) occurring in Ireland, the circumstances, pre-hospital treatment provided and patient outcome.

In 2021 in Ireland, there were 2,906 OHCAs where resuscitation was attempted by Emergency Medical Services (EMS). 34% of these patients were transported to an ED or a cardiac catheterisation laboratory (n=980), with transport occurring more commonly in urban areas than rural (38% vs 23%).1 16% of all cases had a ROSC on arrival at hospital (n=463/2,906).

A total of 178/2,895 patients were discharged alive from hospital (6.1%). A Cerebral Performance Category (CPC) score (Figure 1) was available for 157 surviving patients. 97% (n=152) had a score of 1 or 2. 3% (n=8) had a score of 3 or higher.1

![CPC Score Chart]

Figure 1: Breakdown of the Cerebral Performance Category (CPC) Score2
It is important as Emergency Medicine clinicians that we deliver our part in the chain of survival. We want to ensure that these patients receive high quality post cardiac arrest care to maximise their opportunity for a good neurological recovery.

**Post Cardiac Arrest Syndrome**
Post cardiac arrest syndrome, caused by the prolonged whole-body ischaemia of cardiac arrest, consists of four main components: anoxic brain injury, arrest-related myocardial dysfunction, systemic ischaemic/reperfusion response and the persistent precipitating pathology. 3–5

These four components will vary in severity for each patient but are useful to consider in guiding post ROSC management. The overall goals of post ROSC care are to support bodily functions through this post cardiac arrest syndrome, determine the cause of the arrest and to treat accordingly.
PARAMETERS

Target audience  This guideline is directed at Emergency Medicine (EM) Clinicians and Emergency Nurses caring for patients who suffer a cardiac arrest and obtain a ROSC.

Patient population  Adult patients brought to the ED with ROSC after an OHCA, or patients with ROSC who suffered a cardiac arrest while in the ED.

Exclusion criteria  **Paediatric Patients** - while the initial assessment and management elements of this guideline will be relevant to a paediatric population, the aetiology of paediatric cardiac arrest are different to an adult population.

**Traumatic Cardiac Arrest** - This guideline is focused on patients suffering cardiac arrest of medical aetiology.

AIMS

To provide an evidence-based structured approach to the assessment and management of post-cardiac arrest care which is relevant to practice in Irish EDs.
ASSESSMENT

Post cardiac arrest patients are a heterogeneous group and thus not all elements of the guideline will apply to every patient. For post-cardiac arrest care, patients are broadly categorised into ST Segment Elevation Myocardial Infarction (STEMI) vs other suspected cause and awake vs comatose.

Pre-Arrival Preparation

Patients who have achieved a ROSC frequently have significant haemodynamic instability and may suffer another cardiac arrest before arriving to the ED or shortly after arriving in the resuscitation room. Thus, when preparing to receive a post-ROSC patient it is worth preparing the team and equipment to manage a patient in cardiac arrest.

History

Obtain and document an accurate history from the Pre-Hospital Team and family members / witnesses. Included in the handover template below are salient points of the history to obtain from the pre-hospital clinicians / family.

Delegate a team member to obtain a collateral history from the patient’s family and review the patient’s medical chart.
Handover from Pre-Hospital Team

*I MIST AMBO* - handover template used by EMS in Ireland.6

<table>
<thead>
<tr>
<th>I</th>
<th>Identification</th>
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<tbody>
<tr>
<td>M</td>
<td>Mechanism of Injury / Medical Complaint</td>
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<td></td>
<td>Preceding Symptoms / Illness?</td>
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<tr>
<td>I</td>
<td>Injuries or Information relating to complaint</td>
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<td></td>
<td>Witnessed / Unwitnessed?</td>
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<td>Bystander CPR?</td>
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<td>S</td>
<td>Signs</td>
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<td>Presenting Rhythm?</td>
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<td>HR, BP, SpO2, etCO2</td>
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<td>T</td>
<td>Treatment &amp; Trends</td>
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<td></td>
<td>Number of Shocks</td>
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<td></td>
<td>Drugs Administered</td>
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<td>Approximate total down time (no-flow: collapse to onset of CPR, low-flow: onset of CPR to ROSC)</td>
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<td>Time to first breath (if breathing spontaneously)</td>
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<td>Type of Airway in Situ / ETT position</td>
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<td>A</td>
<td>Allergies</td>
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<td>M</td>
<td>Medications</td>
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<td>B</td>
<td>Background History</td>
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<td>O</td>
<td>Other Information</td>
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<td>Details of any Pre-Hospital Discussion with Cardiology?</td>
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<td>Ceiling of Care / DNAR Orders?</td>
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<td>Other issues or observations</td>
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<td></td>
<td>NOK Contact Details</td>
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<td></td>
<td>Review of Pre-Hospital ECGs</td>
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</table>
**Initial Assessment & Primary Survey**[^7][^8]

Ideally the ABC interventions described below should happen concurrently where resources allow.

**Airway**

If the patient has been intubated during Cardiopulmonary resuscitation (CPR): confirm tube position with etCO₂ and auscultation. Note the tube position at the teeth and adjust if required. If not yet intubated, comatose patients post ROSC should undergo neuroprotective Rapid Sequence Induction (RSI) for tracheal intubation with waveform capnography confirmation and monitoring. Ensure cardiovascular optimisation prior to administering drugs for intubation and adjust drug dosage appropriately for shocked patients. “Resuscitate before you Intubate”.

**Breathing**

Administer 100% oxygen immediately post-ROSC until arterial oxygen saturation or partial pressure of arterial oxygen (PaO₂) can be measured reliably. Target oxygen saturation of 94-98% or PaO₂ of 10-13kPa (75-100mmHg). In ventilated patients use lung protective ventilation, with tidal volumes of 6-8ml/kg of ideal body weight.

![Table of Ideal Body Weight and Corresponding Tidal Volumes](https://emcrit.org/pulmcrit/endotracheal-tube-depth/)

[^7]: IAEM CG: Post Cardiac Arrest Care
[^8]: Version 1.0, June 2023
Adjust ventilation to target a normal partial pressure of arterial carbon dioxide (PaCO₂) of 4.5-6.0kPa or 35-45mmHg. Consider inserting an orogastric or nasogastric tube to decompress the stomach to potentially improve ventilation and reduce aspiration risk. This may also be useful for administering antiplatelet agents in patients with STEMI.

Circulation

Perform a 12-lead ECG. Discuss immediately with Primary Percutaneous Coronary Intervention (PCI) Centre if STEMI present. Ensure continuous cardiac monitoring of the patient. In the haemodynamically unstable comatose patient, consider how you will detect if the patient re-arrests. (e.g. continuous palpation of pulse by team member, etCO₂ monitoring, NIBP cycling every 2-5 minutes, arterial line).

Manage haemodynamic parameters with fluids and/or vasopressors and inotropes, likely via peripheral access initially. During initial resuscitation target systolic blood pressure >100mmHg or mean arterial pressure (MAP) >65mmHg. Subsequent targets include: urine output (>0.5ml/kg/hr) and normal or decreasing lactate.

Obtain a venous blood gas (VBG) and correct electrolyte disturbances. Insert an arterial line for continuous haemodynamic monitoring. Inexperienced operators should avoid the right radial artery to ensure patency for PCI. Perform early echocardiography to detect underlying cardiac pathology (e.g. pericardial effusion) and quantify the degree of myocardial dysfunction.

Central venous access will likely be required in comatose patients being admitted to the intensive care unit.

In patients with persistent cardiogenic shock resistant to fluid resuscitation, inotropes and vasoactive medications, consider early cardiac catheterisation laboratory evaluation, mechanical circulatory support (intra-aortic balloon pump), left-ventricular assist device or extra-corporeal membrane oxygenation.
**Disability**

Routine seizure prophylaxis is not advised in post-cardiac arrest patients. Treat clinically apparent apparent seizures. For treatment of seizures after cardiac arrest, Levetiracetam or Sodium Valproate are the recommended first-line antiepileptic drugs in addition to sedative drugs. Short acting sedatives and opioids (e.g. propofol, alfentanil, remifentanil) will enable more reliable and earlier neurological assessment for prognostication. Use of midazolam has been associated with delayed awakening. Propofol use is associated with more frequent need of noradrenaline.⁷

**Environment**

**Temperature Control** in comatose patients is recommended.¹⁰

- Maintain a target temperature at a constant value <37.5°C to prevent fever in patients who remain comatose after ROSC. ¹⁰
- Comatose patients with mild hypothermia after ROSC should NOT be actively warmed to achieve normothermia.
- Avoid fever (>37.7°C) for at least 72h after ROSC in patients who remain in a coma. ¹⁰
- If there is severe cardiovascular impairment at 33°C, a higher temperature might be targeted.

Avoid hypoglycaemia, target a blood glucose of 7.8-10mmol/L.
INVESTIGATIONS STRATEGY

Coronary Reperfusion
Emergency cardiac catheterisation laboratory evaluation (and immediate PCI if required) should be performed in adult patients with ROSC after cardiac arrest of suspected cardiac origin with ST-elevation on the ECG.7

In patients with ROSC after out-of-hospital cardiac arrest (OHCA) without ST-elevation on the ECG, emergency cardiac catheterisation laboratory evaluation should be considered if there is an estimated high probability of acute coronary occlusion (e.g. patients with haemodynamic and/or electrical instability).7

Diagnostic Imaging
Point of Care Ultrasound (POCUS) is a useful adjunct to the initial assessment and primary survey. It can aid in the diagnosis of potential causes of cardiac arrest such as pericardial effusion.11 It can also rapidly detect CPR related injuries such as pneumothorax,11 which is important to identify in patients receiving positive pressure ventilation.

Chest X-ray
Chest X-ray should be undertaken to identify any obvious cardiopulmonary or intra-thoracic pathology and to confirm endotracheal tube (ETT) placement and line placement.
**Computed Tomography**

**CT Brain**
To screen for intracranial haemorrhage as the cause of cardiac arrest.

**Additional CT imaging** (e.g., CT pulmonary angiogram (CT-PA), CT abdomen/pelvis, CT cervical spine) should be performed in line with clinical suspicion to exclude potential aetiologies of cardiac arrest e.g., pulmonary embolism, acute aortic syndrome (dissection) and haemoperitoneum, and to identify both iatrogenic injuries from CPR and traumatic injuries from the collapse.

Be mindful of frail older patients who sustained a fall during their cardiac arrest, imaging of the head should also include the cervical spine.\(^{12-15}\)

**Near Hanging with Anoxic Brain Injury**
In line with the modified Denver criteria for blunt cerebrovascular injury, near hanging patients with anoxic brain injury should undergo CT-angiogram of the neck vessels to exclude blunt cerebrovascular injury.\(^{16,17}\)

**Laboratory Evaluation**
Comprehensive bloods should be sent including Full Blood Count, Urea & Electrolytes, Liver Function Tests, High-sensitivity Troponin, Calcium, Phosphate, Magnesium, Coagulation Profile, Blood Type and Screen, and blood gas. Consider performing a Urine Toxicological Screen.
PATIENT DISPOSITION

Patients meeting the criteria for Primary PCI should be discussed with and transferred emergently to the PCI centre. Comatose patients should be admitted to an intensive care unit. Awake patients maintaining their own airway should receive close monitoring in a Coronary Care Unit.

SPECIAL CONSIDERATIONS

End of Life Discussions
For frail older patients, and patients with significant co-morbidities or terminal illness, an early discussion with the patient’s relatives is important to determine the patient’s wishes around resuscitation in case of further deterioration. For older patients, this discussion should be informed by objective tools such as the Rockwood Clinical Frailty Scale.

Palliation
In certain comatose patients with very poor pre-morbid status, in consultation with the family and a senior clinician, palliative extubation may be appropriate.
APPENDIX 1: POST RESUSCITATION CARE ALGORITHM

Post Resuscitation Care

A
- Early Neuroprotective RSI for Comatose patients
- Waveform capnography

B
- Maintain SpO₂ 94-98%
- Ventilate to normocapnia (4.5-6.0 kPa)
- Lung Protective Ventilation
- Portable CXR

C
- Obtain reliable IV Access
- Aim: SBP >100mmHg (MAP>65mmHg)
- Crystalloid to restore normovolaemia
- Arterial Line
- Vasopressors / Inotropes as required

12-Lead ECG

STEMI
- Contact Cardiology for emergent angiography +/- PCI

No STEMI
- Targets
  - PaO₂: 10-13 kPa
  - SaO₂: 94-98%
  - PaCO₂: 4.5-6kPa
  - MAP >65mmHg
  - Avoid Fever (>37.7℃)
- Comatose
  - Investigate Aetiology: CT Brain +/- CT-PA Echo
- Alert
  - Investigate Aetiology as per clinical findings. Echo
- Temperature Control
- Treat Clinical Seizures
- Admit to ICU
- Admit to Monitored Area

Consider Angiography without STEMI:
- Unstable Cardiogenic Shock
- Electrical Instability
- Mechanical Circulatory Support Required

A. Patton 2023
REFERENCES


