

IRISH ASSOCIATION FOR  
EMERGENCY  
MEDICINE



IAEM Clinical Guideline

## Post Cardiac Arrest Care

Version 1.0

June 2023

Authors: Dr Andrew Patton, Dr Íomhar O'Sullivan

In Collaboration with IAEM Clinical Guideline Development Committee

**To reference this document please reference as:**

Patton A, O'Sullivan Í. Post Cardiac Arrest Care. IAEM Guidelines 2023.  
<https://iaem.ie/professional/clinical-guidelines/> (accessed 28<sup>th</sup> June 2023)

### 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.

<b>Revision History</b>	<b>Section</b>	<b>Summary of Changes</b>	<b>Author</b>
Final version V1.0	All		

## CONTENTS

<b>GLOSSARY OF TERMS .....</b>	<b>5</b>
<b>INTRODUCTION .....</b>	<b>6</b>
<i>Figure 1: Breakdown of the Cerebral Performance Category (CPC) Score.....</i>	<i>6</i>
<b>Post Cardiac Arrest Syndrome .....</b>	<b>7</b>
<b>PARAMETERS.....</b>	<b>8</b>
<b>AIMS.....</b>	<b>8</b>
<b>ASSESSMENT .....</b>	<b>9</b>
<b>Pre-Arrival Preparation .....</b>	<b>9</b>
<b>History .....</b>	<b>9</b>
<b>Handover from Pre-Hospital Team.....</b>	<b>10</b>
<b>Initial Assessment &amp; Primary Survey .....</b>	<b>11</b>
Airway .....	11
Breathing.....	11
<i>Table 1:Table of Ideal Body Weight and Corresponding Tidal Volumes. ....</i>	<i>11</i>
Circulation .....	12
Disability.....	13
Environment.....	13
<b>INVESTIGATIONS STRATEGY .....</b>	<b>14</b>
<b>Coronary Reperfusion .....</b>	<b>14</b>
<b>Diagnostic Imaging .....</b>	<b>14</b>
Point of Care Ultrasound (POCUS) .....	14
Chest X-ray .....	14
Computed Tomography.....	15
CT Brain.....	15
Additional CT imaging .....	15
Near Hanging with Anoxic Brain Injury .....	15
<b>Laboratory Evaluation .....</b>	<b>15</b>
<b>PATIENT DISPOSITION.....</b>	<b>16</b>
<b>SPECIAL CONSIDERATIONS .....</b>	<b>16</b>

End of Life Discussions.....	16
Palliation.....	16
Appendix 1: Post Resuscitation Care Algorithm.....	17
REFERENCES.....	18

## GLOSSARY OF TERMS

BP	Blood Pressure
CPC Score	Cerebral Performance Category Score
CPR	Cardiopulmonary resuscitation
CT-PA	Computed Tomography Pulmonary Angiogram
CT	Computed Tomography
DNAR	Do not attempt resuscitation
ECG	Electrocardiogram
ED	Emergency Department
EM	Emergency Medicine
EMS	Emergency Medical Services
etCO <sub>2</sub>	End-tidal Carbon Dioxide
ETT	Endotracheal tube
HR	Heart rate
kPa	kilopascal
MAP	Mean Arterial Pressure
mmHg	Millimetres of Mercury
NIBP	Non-invasive Blood Pressure
NOK	Next of Kin
OHCA	Out of Hospital Cardiac Arrest
PaCO <sub>2</sub>	Partial Pressure of Arterial Carbon Dioxide
PaO <sub>2</sub>	Partial Pressure of Arterial Oxygen
PCI	Percutaneous Coronary Intervention
POCUS	Point of Care Ultrasound
ROSC	Return of Spontaneous Circulation
RSI	Rapid Sequence Induction
SpO <sub>2</sub>	Oxygen saturation
STEMI	ST Segment Elevation Myocardial Infarction
VBG	Venous Blood Gas – Point of Care Test
OHCAR	Out of Hospital Cardiac Arrest Registry

# 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 OHCA's 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%).<sup>1</sup> 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.<sup>1</sup>

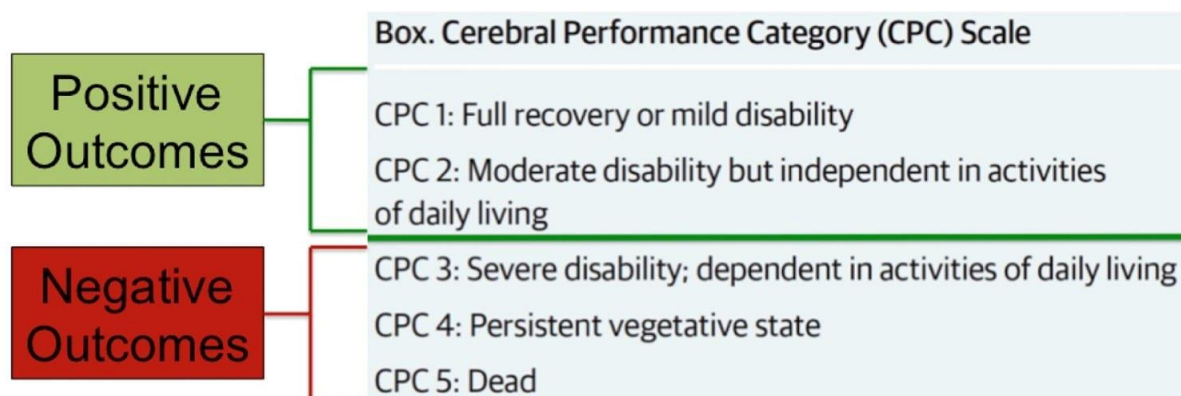


Figure 1: Breakdown of the Cerebral Performance Category (CPC) Score<sup>2</sup>

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.<sup>3-5</sup>

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	<p><b>Paediatric Patients</b> - 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.</p> <p><b>Traumatic Cardiac Arrest</b> - This guideline is focused on patients suffering cardiac arrest of medical aetiology.</p>

## 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 heterogenous 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.<sup>6</sup>

<b>I</b>	Identification	
<b>M</b>	Mechanism of Injury / Medical Complaint	Preceding Symptoms / Illness?
<b>I</b>	Injuries or Information relating to complaint	Witnessed / Unwitnessed? Bystander CPR?
<b>S</b>	Signs	Presenting Rhythm? HR, BP, SpO <sub>2</sub> , etCO <sub>2</sub>
<b>T</b>	Treatment & Trends	Number of Shocks Drugs Administered Approximate total down time (no-flow: collapse to onset of CPR, low-flow: onset of CPR to ROSC) Time to first breath (if breathing spontaneously) Type of Airway in Situ / ETT position
<b>A</b>	Allergies	
<b>M</b>	Medications	
<b>B</b>	Background History	
<b>O</b>	Other Information	Details of any Pre-Hospital Discussion with Cardiology? Ceiling of Care / DNAR Orders? Other issues or observations NOK Contact Details Review of Pre-Hospital ECGs

## Initial Assessment & Primary Survey<sup>7,8</sup>

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 etCO<sub>2</sub> 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 (PaO<sub>2</sub>) can be measured reliably. Target oxygen saturation of 94-98% or PaO<sub>2</sub> of 10-13kPa (75-100mmHg). In ventilated patients use lung protective ventilation, with tidal volumes of 6-8ml/kg of ideal body weight.

Height (inches)	Height (cm)	ETT depth	Female		Male		
			6 ml	8 ml	6 ml	8 ml	
5' 0"	60	152	19	270	360	300	400
5' 2"	62	157	20	300	400	330	440
5' 4"	64	163	20	330	440	360	470
5' 6"	66	168	21	360	470	380	510
5' 8"	68	173	21	380	510	410	550
5' 10"	70	178	22	410	550	440	580
6' 0"	72	183	23	440	580	470	620
6' 2"	74	188	23	470	620	490	660
6' 4"	76	193	24	490	660	520	690

Table 1: Table of Ideal Body Weight and Corresponding Tidal Volumes.<sup>9</sup>

Source: <https://emcrit.org/pulmcrit/endotracheal-tube-depth/>

Adjust ventilation to target a normal partial pressure of arterial carbon dioxide (PaCO<sub>2</sub>) 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, etCO<sub>2</sub> 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 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.<sup>7</sup>

### *Environment*

**Temperature Control** in comatose patients is recommended.<sup>10</sup>

- Maintain a target temperature at a constant value  $<37.5^{\circ}\text{C}$  to prevent fever in patients who remain comatose after ROSC.<sup>10</sup>
- Comatose patients with mild hypothermia after ROSC should NOT be actively warmed to achieve normothermia.
- Avoid fever ( $>37.7^{\circ}\text{C}$ ) for at least 72h after ROSC in patients who remain in a coma.<sup>10</sup>
- If there is severe cardiovascular impairment at  $33^{\circ}\text{C}$ , 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.<sup>7</sup>

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).<sup>7</sup>

### 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.<sup>11</sup> It can also rapidly detect CPR related injuries such as pneumothorax,<sup>11</sup> 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.<sup>12–15</sup>

### *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.<sup>16,17</sup>

## **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 the Rockwood Clinical Frailty Scale.

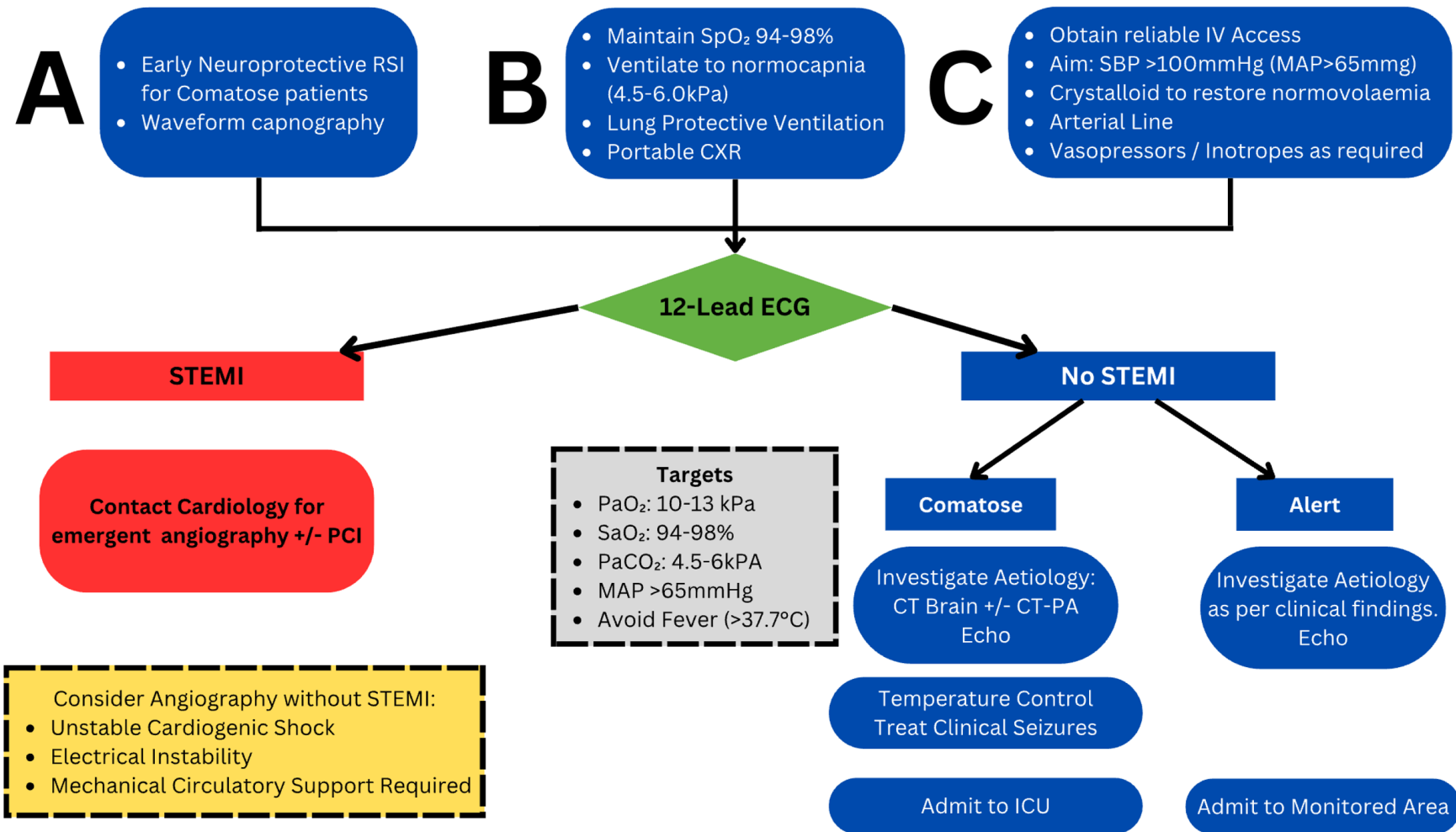
### **Palliation**

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



## REFERENCES

1. Out of Hospital Cardiac Arrest Register - Annual Report 2021. Department of Public Health Medicine; 2022.
2. Ramzy M. MIRACLE2 Risk Score for Early Prediction of Neurologic Outcome in Out-of-Hospital Cardiac Arrest [Internet]. REBEL EM - Emergency Medicine Blog. 2021 [cited 2023 May 14]. Available from: <https://rebelem.com/miracle2-risk-score-for-early-prediction-of-neurologic-outcome-in-out-of-hospital-cardiac-arrest/>
3. Nolan JP, Neumar RW, Adrie C, Aibiki M, Berg RA, Böttiger BW, et al. Post-cardiac arrest syndrome: Epidemiology, pathophysiology, treatment, and prognostication. *Resuscitation*. 2008 Dec;79(3):350–79.
4. Stub D, Bernard S, Duffy SJ, Kaye DM. Post cardiac arrest syndrome: A review of therapeutic strategies. *Circulation*. 2011;123(13):1428–35.
5. Mongardon N, Dumas F, Ricome S, Grimaldi D, Hissem T, Pène F, et al. Postcardiac arrest syndrome: from immediate resuscitation to long-term outcome. *Ann Intensive Care*. 2011 Nov 3;1(1):45.
6. Handover of Ambulance Patients in Emergency Departments. 2013;
7. Nolan JP, Sandroni C, Böttiger BW, Cariou A, Cronberg T, Friberg H, et al. European Resuscitation Council and European Society of Intensive Care Medicine Guidelines 2021: Post-resuscitation care. *Resuscitation*. 2021 Apr;161:220–69.
8. Panchal AR, Bartos JA, Cabañas JG, Donnino MW, Drennan IR, Hirsch KG, et al. Part 3: Adult Basic and Advanced Life Support: 2020 American Heart Association Guidelines for Cardiopulmonary Resuscitation and Emergency Cardiovascular Care. *Circulation* [Internet]. 2020 Oct 20 [cited 2023 May 6];142(16\_suppl\_2). Available from: <https://www.ahajournals.org/doi/10.1161/CIR.0000000000000916>

9. Farkas J. PulmCrit- Devil in the details: Endotracheal tube depth [Internet]. EMCrit. [cited 2023 Jun 5]. Available from: <https://emcrit.org/pulmcrit/endotracheal-tube-depth/>
10. Wyckoff MH, Greif R, Morley PT, Ng KC, Olasveengen TM, Singletary EM, et al. 2022 International Consensus on Cardiopulmonary Resuscitation and Emergency Cardiovascular Care Science With Treatment Recommendations: Summary From the Basic Life Support; Advanced Life Support; Pediatric Life Support; Neonatal Life Support; Education, Implementation, and Teams; and First Aid Task Forces. *Resuscitation*. 2022 Dec 1;181:208–88.
11. Lau YH, See KC. Point-of-care ultrasound for critically-ill patients: A mini-review of key diagnostic features and protocols. *World J Crit Care Med*. 2022 Mar 9;11(2):70–84.
12. BOAST: The care of the older or frail orthopaedic trauma patient [Internet]. British Geriatrics Society. [cited 2023 May 3]. Available from: <https://www.bgs.org.uk/resources/boast-the-care-of-the-older-or-frail-orthopaedic-trauma-patient>
13. Miyata K, Mikami T, Koyanagi I, Mikuni N, Narimatsu E. Cervical spinal cord injuries associated with resuscitation from fatal circulatory collapse. *Acute Medicine & Surgery*. 2016;3(2):86–93.
14. Turnham HL, Eve R. Cervical spine injury resulting from low impact fall following cardiac arrest. *Resuscitation*. 2012 Dec 1;83(12):e229.
15. Desroziers M, Mole S, Jost D, Tourtier JP. The need to immobilise the cervical spine during cardiopulmonary resuscitation and electric shock administration in out-of-hospital cardiac arrest. *BMJ Case Rep*. 2016 Jun 13;2016:bcr2016214659.

16. Burlew CC, Biffi WL, Moore EE, Barnett CC, Johnson JL, Bensard DD. Blunt cerebrovascular injuries: Redefining screening criteria in the era of noninvasive diagnosis. *Journal of Trauma and Acute Care Surgery*. 2012 Feb;72(2):330.
17. Geddes AE, Burlew CC, Wagenaar AE, Biffi WL, Johnson JL, Pieracci FM, et al. Expanded screening criteria for blunt cerebrovascular injury: a bigger impact than anticipated. *The American Journal of Surgery*. 2016 Dec 1;212(6):1167–74.