

## Post-resuscitation care guidelines

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## Key points

There are relatively few changes in the post-resuscitation care guidelines in comparison with those published in 2015. The main changes are:

- Alignment with [European Society of Cardiology guidelines](#) for the indications for immediate coronary angiography in post-resuscitation patients without ST-elevation on their 12-lead ECG.
- Following return of spontaneous circulation (ROSC), aim to maintain a mean arterial blood pressure of > 65 mmHg. Over this threshold optimal blood pressure targets are likely to need to be optimised.

- Levetiracetam and sodium valproate are preferred instead of phenytoin for the treatment of seizures.
- Continuously monitor the core temperature in patients who remain comatose after ROSC.
- Actively prevent fever (defined as a temperature  $> 37.7^{\circ}\text{C}$ ) for at least 72 h in post-cardiac arrest patients who remain comatose.
- The multimodal prognostication guidelines have been updated. In a comatose patient with a Glasgow Motor Score of  $M \leq 3$  at  $\geq 72$  h from ROSC, in the absence of confounders, poor outcome is likely when two or more of the following predictors are present:
  - no pupillary and corneal reflexes at  $\geq 72$  h
  - bilaterally absent N20 SSEP wave at  $\geq 24$  h
  - highly malignant EEG (suppressed background or burst suppression) at  $\geq 24$  h
  - NSE  $>60$  mcg  $\text{L}^{-1}$  at 48 h and/or 72 h
  - status myoclonus  $\leq 72$  h
  - or a diffuse and extensive anoxic injury on brain CT/MRI.
- Greater emphasis is placed on screening cardiac arrest survivors for physical, cognitive and emotional problems and, where indicated, referring for rehabilitation.

## Introduction

Management of cardiac arrest in patients with known or suspected COVID-19 is not specifically included in these guidelines, but is covered within [RCUK's separate COVID-19 guidance](#).

Guidelines 2021 are based on the International Liaison Committee on Resuscitation 2020 Consensus on Science and Treatment Recommendations and the European Resuscitation Council Guidelines for Resuscitation (2021). Refer to the ERC guidelines publications for supporting reference material.

The process used to produce the Resuscitation Council UK Guidelines 2021 is accredited by the National Institute for Health and Care Excellence (NICE). The guidelines process includes:

- systematic reviews with grading of the quality of evidence and strength of recommendations. This led to the International Liaison Committee on Resuscitation (ILCOR) Consensus on Cardiopulmonary Resuscitation and Emergency Cardiovascular Care Science with Treatment Recommendations

- the involvement of stakeholders from around the world including members of the public and cardiac arrest survivors.
- Details of the guidelines development process can be found in the Resuscitation Council UK [Guidelines Development Process Manual](#).

## **Guidelines**

This section includes only a summary of the main recommendations. The evidence underpinning each recommendation is detailed in the European Resuscitation Council Guidelines.

### **Immediate post-resuscitation care**

- Post-resuscitation care is started immediately after sustained ROSC, regardless of location.
- Following out-of-hospital cardiac arrest, consider transport to a recognised centre of care (e.g cardiac arrest centre).

### **Diagnosis of cause of cardiac arrest**

- If there is clinical (e.g. haemodynamic instability) or ECG evidence of myocardial ischaemia, undertake coronary angiography first. This is followed by CT brain and/or CT pulmonary angiography if coronary angiography fails to identify causative lesions.
- Early identification of a respiratory or neurological cause can be achieved by performing a brain and chest CT-scan at hospital admission, before or after coronary angiography (see coronary reperfusion).
- If there are signs or symptoms pre-arrest suggesting a neurological or respiratory cause (e.g. headache, seizures or neurological deficits, shortness of breath or documented hypoxaemia in patients with known respiratory disease), perform a CT brain and/or a CT pulmonary angiogram.

### **Airway and breathing**

#### **Airway management after return of spontaneous circulation**

- Airway and ventilation support should continue after return of spontaneous circulation (ROSC) is achieved.

- Patients who have had a brief period of cardiac arrest and an immediate return of normal cerebral function and are breathing normally may not require tracheal intubation but should be given oxygen via a face mask if their arterial blood oxygen saturation is less than 94%.
- Patients who remain comatose following ROSC, or who have another clinical indication for sedation and mechanical ventilation, should have their trachea intubated if this has not been done already during CPR.
- Tracheal intubation should be performed only by experienced operators who have a high success rate.
- Correct placement of the tracheal tube must be confirmed with waveform capnography.
- In the absence of personnel experienced in tracheal intubation, it is reasonable to insert a supraglottic airway (SGA) or maintain the airway with basic techniques until skilled intubators are available.

### **Control of oxygenation**

- After ROSC, use 100% (or maximum available) inspired oxygen until the arterial oxygen saturation or the partial pressure of arterial oxygen can be measured reliably.
- After ROSC, once SpO<sub>2</sub> can be measured reliably or arterial blood gas values are obtained, titrate the inspired oxygen to achieve an arterial oxygen saturation of 94-98% or arterial partial pressure of oxygen (PaO<sub>2</sub>) of 10-13 kPa or 75-100 mmHg.
- Avoid hypoxaemia (PaO<sub>2</sub> < 8 kPa or 60 mmHg) following ROSC.
- Avoid hyperoxaemia following ROSC.

### **Control of ventilation**

- Obtain an arterial blood gas and use end tidal CO<sub>2</sub> in mechanically ventilated patients.
- In patients requiring mechanical ventilation after ROSC, adjust ventilation to target a normal arterial partial pressure of carbon dioxide (PaCO<sub>2</sub>) i.e. 4.5-6.0 kPa or 35-45 mmHg.
- Use a lung protective ventilation strategy aiming for a tidal volume of 6-8 mL kg<sup>-1</sup> ideal body weight.

## **Circulation**

### **Coronary reperfusion**

- Emergent 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.
- In patients with ROSC after out-of-hospital cardiac arrest (OHCA) without ST-elevation on the ECG, emergent 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).

## **Haemodynamic monitoring and management**

- All patients should be monitored with an arterial line for continuous blood pressure measurements, and it is reasonable to monitor cardiac output in haemodynamically unstable patients.
- Perform early (as soon as possible) echocardiography in all patients to detect any underlying cardiac pathology and quantify the degree of myocardial dysfunction.
- Avoid hypotension (< 65 mmHg). Target mean arterial pressure (MAP) to achieve adequate urine output (> 0.5 mL kg<sup>-1</sup>h<sup>-1</sup>) and normal or decreasing lactate.
- Maintain perfusion with fluids, noradrenaline and/or dobutamine, depending on individual patient need for intravascular volume, vasoconstriction or inotropy.
- Do not give steroids routinely after cardiac arrest.
- Avoid hypokalaemia, which is associated with ventricular arrhythmias.
- Consider mechanical circulatory support (such as intra-aortic balloon pump, left-ventricular assist device or arterio-venous extra corporal membrane oxygenation) for persisting cardiogenic shock from left ventricular failure if treatment with fluid resuscitation, inotropes, and vasoactive drugs is insufficient. Left-ventricular assist devices or arterio-venous extra corporal membrane oxygenation should also be considered in haemodynamically unstable patients with acute coronary syndromes (ACS) and recurrent ventricular tachycardia (VT) or ventricular fibrillation (VF) despite optimal therapy.

## **Disability (optimising neurological recovery)**

### **Control of seizures**

- We recommend using electroencephalography (EEG) to diagnose electrographic seizures in patients with clinical convulsions and to monitor

treatment effects.

- To treat seizures after cardiac arrest, we suggest levetiracetam or sodium valproate as first-line antiepileptic drugs in addition to sedative drugs.
- We suggest that routine seizure prophylaxis is not used in post-cardiac arrest patients.

## **Temperature control**

- Continuously monitor core temperature in patients who remain comatose after ROSC.
- Actively prevent fever (defined as a temperature  $> 37.7^{\circ}\text{C}$ ) for at least 72 h in post-cardiac arrest patients who remain comatose.

## **General intensive care management**

- Use short-acting sedatives and opioids.
- Avoid using a neuromuscular blocking drug routinely in patients undergoing temperature control unless there is severe shivering.
- Provide stress ulcer prophylaxis routinely in cardiac arrest patients.
- Provide deep venous thrombosis prophylaxis.
- Target a blood glucose of 7.8–10 mmol L<sup>-1</sup> using an infusion of insulin if required; avoid hypoglycaemia ( $< 4.0$  mmol L<sup>-1</sup>).
- Start enteral feeding at low rates (trophic feeding) and increase as tolerated.
- We do not recommend using prophylactic antibiotics routinely.

## **Prognostication**

### **General guidelines**

- In patients who are comatose after resuscitation from cardiac arrest, neurological prognostication should be performed using clinical examination, electrophysiology, biomarkers, and imaging, to both inform patient's relatives and to help clinicians to target treatments based on the patient's chances of achieving a neurologically meaningful recovery
- No single predictor is 100% accurate. Therefore, a multimodal neuroprognostication strategy is recommended.
- When predicting poor neurological outcome, a high specificity and precision are desirable, to avoid falsely pessimistic predictions.
- The clinical neurological examination is central to prognostication. To avoid falsely pessimistic predictions, clinicians should avoid potential confounding from sedatives and other drugs that may confound the results of the tests.

- Clinicians must be aware of the risk of a self-fulfilling prophecy bias, occurring when the results of an index test predicting poor outcome is used for treatment decisions, especially regarding life-sustaining therapies.
- Tests for neurological prognostication are aimed at assessing the severity of hypoxic-ischaemic brain injury. The neurological prognosis is one of several aspects to consider in discussions around an individual's potential for recovery.

### **Multimodal prognostication**

- Start the prognostication assessment with an accurate clinical examination, to be performed only after major confounders (e.g. residual sedation, hypothermia) have been excluded.
- In a comatose patient with  $M \leq 3$  at  $\geq 72$  h from ROSC, in the absence of confounders, poor outcome is likely when two or more of the following predictors are present: no pupillary and corneal reflexes at  $\geq 72$  h, bilaterally absent N20 somatosensory evoked potential (SSEP) wave at  $\geq 24$  h, highly malignant EEG at  $>24$ h, neuron specific enolase (NSE)  $> 60$  mcg  $L^{-1}$  at 48 h and/or 72 h, status myoclonus  $\leq 72$  h, or a diffuse and extensive anoxic injury on brain CT/MRI. Most of these signs can be recorded before 72 h from ROSC, however their results will be evaluated only at the time of clinical prognostic assessment.

### **Withdrawal of life-sustaining therapy**

- Separate discussions around withdrawal of life-sustaining therapy (WLST) and the assessment of prognosis for neurological recovery; WLST decisions should consider aspects other than brain injury such as age, co-morbidity, general organ function and the patients' preferences.
- Allocate sufficient time for communication around the level-of-treatment decision within the team and with the relatives.

### **Long-term outcome after cardiac arrest**

- Perform functional assessments of physical and non-physical impairments before discharge from the hospital to identify early rehabilitation needs and refer to rehabilitation if necessary
- Organise follow-up for all cardiac arrest survivors within 3 months after hospital discharge, including:

1. Screening for cognitive problems.

2. Screening for emotional problems and fatigue.
3. Providing information and support for survivors and family members.

## Organ donation

- All decisions concerning organ donation must follow local legal and ethical requirements.
- Organ donation should be considered in those who have achieved ROSC and who fulfil neurological criteria for death.
- In comatose ventilated patients who do not fulfil neurological criteria for death, if a decision to start end-of-life care and withdrawal of life support is made, organ donation should be considered for when circulatory arrest occurs.

## Recognised centres of care

- Adult patients with non-traumatic OHCA should be considered for transport to a recognised centre of care (e.g. cardiac arrest centre or heart attack centre) for appropriate specialist treatment, according to local protocols.
- Adult patients with a cardiac arrest of presumed cardiac aetiology should be transported directly to a hospital with 24/7 coronary angiography capability.

## References

ERC Guidelines 2021: <https://cprguidelines.eu/>

Nolan JP, Sandroni C, Andersen LW, Böttiger BW, Cariou A, Cronberg T, Friberg H, Genbrugge C, Lilja G, Morley PT, Nikolaou N, Olasveengen TM, Skrifvars MB, Taccone FS, Soar J. ERC-ESICM guidelines on temperature control after cardiac arrest in adults. *Resuscitation*. 2022 Mar;172:229-236.

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