Resuscitation Council UK

Special circumstances Guidelines

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General recommendation

- Initiate resuscitation following the standard ALS algorithm in cardiac arrest.
- Always address hypoxia, hypovolaemia, electrolyte disorders, hypothermia, cardiac tamponade, tension pneumothorax, thrombosis, and toxins.
- Where appropriate, prioritise treating reversible causes, even if chest compressions are briefly interrupted.

Guidelines: Special causes

Management and prevention of cardiac arrest due to anaphylaxis

For detailed management of anaphylaxis, refractory anaphylaxis, and peri-operative anaphylaxis, see RCUK's Emergency treatment of anaphylactic reactions: Guidelines for healthcare providers.

- Prompt recognition of anaphylaxis is crucial.
- Recognise anaphylaxis by the presence of airway, breathing, or circulation problems with or without skin and mucosal changes.
- Remove or stop the trigger if immediately feasible.
- Immediately inject intramuscular adrenaline 500 mcg (1 mg mL^{-1} concentration) at first suspicion of anaphylaxis and repeat if no improvement occurs within 5 min.
- Give an IV crystalloid fluid bolus early and monitor the response.

Hyper/hypokalaemia and other electrolyte disorders

Hyperkalaemia

- Shift potassium into cells
  - Give 10 units soluble insulin and 25 g glucose IV for treatment of moderate hyperkalaemia (6.0-6.4 mmol L^{-1}) and severe hyperkalaemia (> 6.5 mmol L^{-1}). Follow with 10% glucose infusion at 50 mL h^{-1} for 5 h if pre-treatment blood glucose < 7 mmol L^{-1}.
  - Give nebulised salbutamol (10-20 mg) for moderate and severe hyperkalaemia, as an adjunct to insulin-glucose therapy.
- Antagonise the effect of hyperkalaemia in:
  - **severe hyperkalaemia with ECG changes:** administer 10 mL of 10% calcium chloride IV over 5 min; if this is not available, give 30 mL of 10% calcium gluconate over 10 min.
  - **hyperkalaemic cardiac arrest:** administer 10 mL 10% calcium chloride IV and 50 mmol sodium bicarbonate IV, through separate lines or with a flush in between.

- Remove potassium from the body:
  - Give sodium zirconium cyclosilicate 10 g orally.
  - Consider dialysis for patients with refractory severe hyperkalaemia.
- Consider extracorporeal life support (ECPR) in accordance with local protocols if the initial resuscitation attempt is unsuccessful.

Hypokalaemia

- Treatment is guided by the severity of hypokalaemia and the presence of symptoms and/or ECG abnormalities.
- Where appropriate, replace potassium and correct magnesium deficit concurrently.
- Give 20 mmol potassium chloride IV/IO over 2-3 min, followed by 10 mmol over 2 min in hypokalaemic cardiac arrest, then monitor K^+ level and adjust infusion rate accordingly.

Hyperthermia, malignant hyperthermia and toxin-induced hyperthermia

Hyperthermia

- Measure core temperature to guide treatment.
- Move patient to a cool environment.
- Simple external cooling may involve conductive, convective and evaporative measures (See RCUK Guidelines 2025: First Aid).
- With heat syncope and heat exhaustion, quick removal to a cool place, simple external cooling and provision of fluids are sufficient.
- With heat stroke, prioritise active cooling methods that achieve the most rapid cooling rate, such as application of ice and cold-water immersion.

Accidental hypothermia, drowning

Accidental hypothermia

- Check vital signs for up to 1 min in an unconscious hypothermic patient.
- Measure core temperature with a low-reading thermometer to diagnose accidental hypothermia.

- Use the Swiss Staging System if core temperature cannot be measured.
  - Stage I (Mild): Conscious with shivering, estimated core temperature 35-32°C (95-90°F).
  - Stage II (Moderate): Impaired consciousness (e.g. confusion, lethargy), shivering may be decreased or absent, estimated core temperature 32-28°C (90-82°F).
  - Stage III (Severe): Unconscious, but vital signs (pulse, breathing) are present, estimated core temperature 28-24°C (82-75°F).
  - Stage IV (Deep): Vital signs are absent, estimated core temperature below 24°C (75°F).
- Transfer hypothermic patients with risk factors for imminent cardiac arrest and those in cardiac arrest directly to an ECPR centre for rewarming:
  - heart rate < 45 min^{-1}
  - systolic blood pressure < 90 mmHg
  - ventricular arrhythmia
  - core temperature < 30°C.
- Delay CPR or use intermittent CPR in hypothermic cardiac arrest patients with a core temperature below 28°C when immediate or continuous CPR is not feasible.
- Delay further defibrillation attempts if ventricular fibrillation (VF) persists after three shocks, until core temperature is > 30°C.
- Below 30°C, adrenaline will accumulate and may have more detrimental than beneficial effects. Give IV 1 mg adrenaline (1:10,000) once the core temperature reaches 30°C unless planning imminent initiation of ECPR. Increase administration intervals for adrenaline to 6-10 min if the core temperature is 30-35°C.
- Give a loading dose of 300 mg amiodarone if a shockable rhythm is present, but delay further doses until the core temperature exceeds 30°C.
- Consider using a mechanical CPR device if transport is prolonged or if there are difficulties with the terrain.
- Base in-hospital prognostication of successful rewarming on the Hypothermia Outcome Prediction after Extracorporeal Life Support (HOPE) score.
- Rewarm hypothermic arrested patients with veno-arterial extra-corporeal membrane oxygenation (VA-ECMO).
- Initiate non-extracorporeal life support rewarming if an ECPR centre cannot be reached within a reasonable time (e.g. 6 h).

Drowning

- Rescuers and first responders should prioritise their safety and use the safest rescue technique.
- Bystanders should call for professional help and use rescue techniques with which they feel confident, based on their competencies.
- First responders should use the rescue material and flotation devices they are trained to use.
- Spine immobilisation in water should not delay removing the victim from the water when resuscitation is required.
- Start with 5 ventilations using 100% oxygen when available, continue with standard CPR protocol.
- When delivering rescue breaths with a BVM, minimise ventilation pressures to avoid stomach inflation.
- Consider ECPR if initial resuscitation is unsuccessful, in accordance with local protocols.
- Follow the recommendations for hypothermia if hypothermia is recognised.

Thrombosis

Pulmonary embolism

- Consider pulmonary embolism in all patients with sudden onset of progressive dyspnoea and absence of known heart or pulmonary disease.
- Obtain 12-lead ECG (exclude acute coronary syndrome, look for right ventricle strain).
- Identify haemodynamic instability and high-risk pulmonary embolism.
- Perform bedside echocardiography, looking for RV distention and failure, together with any other possible causes of cardiac arrest.
- Initiate anticoagulation therapy (heparin 80 units kg^{-1} IV) during the diagnostic process, unless signs of bleeding or absolute contraindications.
- Confirm diagnosis with computed tomographic pulmonary angiography (CTPA).
- Consider surgical embolectomy or catheter-directed treatment as an alternative to rescue fibrinolytic therapy in rapidly deteriorating patients.

Cardiac arrest due to pulmonary embolism

- Low $ETCO_2$ values (< 1.7 kPa/13 mmHg) in the presence of confirmed tracheal intubation, appropriate minute volume and high-quality chest compressions may support a diagnosis of pulmonary embolism, although it is

a non-specific sign.
- Use fibrinolytic drugs for cardiac arrest when pulmonary embolism is the **suspected** cause of cardiac arrest.
- Use fibrinolytic drugs, surgical embolectomy, or percutaneous mechanical thrombectomy for cardiac arrest when pulmonary embolism is the **known** cause of cardiac arrest.
- In select patients with suspected pulmonary embolism, consider CPR for 60-90 min after administration of thrombolytic drugs.
- Consider ECPR as a rescue therapy for selected patients with cardiac arrest when conventional CPR is failing in settings in which it is implemented.
- Set up a multidisciplinary team for making decisions on the management of high-risk pulmonary embolism depending on local resources.

Coronary thrombosis

- Strengthen regional networks to ensure timely percutaneous coronary intervention (PCI).
- Transfer the patient to a centre with PCI capability and activate existing STEMI networks in case of ST-elevation or suspected ongoing ischaemia.
- In patients with sustained ROSC and ST-elevation on ECG:
    - Perform immediate coronary angiography (and PCI if required) within 120 min of diagnosis.
    - Consider fibrinolysis in pre-hospital and non-PCI-capable settings if a greater delay is expected.
- In patients with sustained ROSC and no ST-elevation on ECG:
    - Consider immediate coronary angiography (and PCI if required) if the patient is haemodynamically unstable or shows signs of ongoing ischaemia.
    - In stable patients without ischaemic signs, emergency cardiac catheterisation laboratory evaluation can be delayed if there is no estimated high probability of acute coronary occlusion.
    - Assess for non-coronary causes if the clinical context suggests an alternative aetiology of the arrest.
    - Unless ongoing resuscitation is considered futile, transfer patients without sustained ROSC with ongoing CPR to a PCI centre for consideration for angiography or ECPR, depending on available resources and team expertise.

Toxins

- Ensure your personal safety, as direct skin contact (e.g. mouth-to-mouth ventilation) might transmit toxic agents.
- Assess all patients in cardiac arrest for potential poisoning.
- Reduce absorption, consider using specific treatment measures as antidotes, decontamination and enhanced elimination.
- Administer antidotes, where available, as soon as possible.
- Be prepared to continue resuscitation for a prolonged period of time, as the toxin concentration may fall as it is metabolised or excreted during extended resuscitation measures.
- Consult regional or national poison centres for information on the treatment of the poisoned patient (e.g. Toxbase).

Traumatic peri-arrest and cardiac arrest

- Traumatic cardiac arrest is different from cardiac arrest due to medical causes; this is reflected in the treatment algorithm. Figure 1 [Adult traumatic cardiac arrest/peri-arrest] can also be used in a peri-arrest situation.
- The response to traumatic cardiac arrest is time-critical, and success depends on a well-established chain of survival, including focused pre-hospital and specialised trauma centre care.
- Early and aggressive management of reversible causes (e.g. haemorrhage control, airway management, chest decompression) is essential for survival. Focus on identifying and correcting reversible causes, but continue chest compressions unless they delay or preclude the correction of the former.
- Ultrasound aids in identifying the cause of cardiac arrest and guides resuscitative interventions.

Guidelines: Special settings

Cardiac arrest in the Cardiac Catheterisation Laboratory (CCL)

Download the Cath lab algorithm 2025

- Promote adequate training for CCL staff in resuscitation and consider periodic emergency drills.
- Ensure emergency equipment is readily available and functional.
- Plan elective procedures carefully to minimise potential complications and promote the use of safety checklists.

- Consider echocardiography in case of haemodynamic instability or suspected complications.
- Resuscitate according to the ALS algorithm, BUT modify:
  - Apply 3 consecutive shocks in case of an initial shockable rhythm.
  - Consider external or transvenous pacing for extreme bradycardia.
- Consider, in selected cases, depending on clinical context, team expertise and availability:
  - Mechanical CPR, if manual compression is not feasible or safe for the provider.
  - ECPR in selected patients with refractory cardiac arrest, especially if it allows for critical procedures to correct reversible causes.
  - Circulatory support devices, for selected patients in cardiogenic shock after achieving ROSC.

For detailed management of cardiac arrest in the cardiac catheter laboratory, see Joint British Societies' guideline on management of cardiac arrest in the cardiac catheter laboratory.

Cardiac arrest in the operating theatre

- Prevent and mitigate the risk of cardiac arrest through pre-operative screening and identification of high-risk patients, clear communication between surgeons and anaesthetists about potential critical procedures, and use of appropriate monitoring.
- Start chest compressions if the systolic blood pressure suddenly decreases below 50 mmHg, in association with a fall in $ETCO_2$, despite appropriate interventions.
- Inform the surgeon, anaesthetist and the operating room team of the cardiac arrest.
- Initiate high-quality chest compressions and adjust the height of the operating table to improve CPR efficiency.
- Ensure the airway is secure, review the $ETCO_2$ tracing, and deliver effective ventilation, administering 100% oxygen. Exclude unrecognised oesophageal intubation.
- Use ultrasound to guide resuscitation, addressing the reversible causes. Exclude tension pneumothorax.
- Consider early ECPR as therapy for selected patients when conventional CPR is failing.

- Trained healthcare professionals may consider open chest cardiac compression in specific cases as an alternative if ECPR is unavailable.
- Human factors are crucial to improve survival of intraoperative cardiac arrest; ensure familiarity with equipment, assign strategies and roles during surgical team time-outs and include perioperative cardiac arrest in multidisciplinary and interprofessional team training.
- The team leader should be ALS trained. If these skills aren't immediately available in theatre, a 2222 call should be placed to ensure the expertise is sourced.

Local anaesthetic systemic toxicity

- Stop the local anaesthetic if possible.
- Hyperventilate the patient to increase plasma pH if metabolic acidosis is present.
- Give a lower adrenaline dose (≤ 1 mcg kg^{-1} instead of 1 mg IV bolus).
- Give an initial intravenous bolus of 1.5 mL kg^{-1} 20% lipid emulsion followed by an infusion at 15 mL kg^{-1} h^{-1}.
- Boluses may be repeated twice (at 5 min intervals), and the infusion rate can be increased to 30 mL kg^{-1} h^{-1} if needed.
- Continue the infusion until the patient is stable or has received a maximum of 12 mL kg^{-1} of lipid emulsion.
- If ROSC has not been achieved at 5 min, double the rate of lipid infusion, and give a maximum of two additional lipid boluses at 5 min intervals until ROSC has been achieved.
- Consider prolonged resuscitation (> 1 h) and ECPR.
- Treat seizures by administering benzodiazepines.

Cardiac surgery

- Confirm cardiac arrest by clinical signs and pulseless pressure waveforms.
- Consider ultrasound to identify reversible causes.
- Provide up to 3 consecutive shocks in initial VF/pVT.
- Pause epicardial pacing to exclude an underlying shockable rhythm and then adjust to maximum output in asystole or extreme bradycardia.
- Perform re-sternotomy up to 10 days post-surgery within 5 min.
- Provide internal cardiac massage once the chest is reopened.

- Reduce IV adrenaline dose (0.05-0.1 mg).
- Consider ECPR for prolonged resuscitation or minimally invasive cases where reopening may be delayed.

Left ventricular assist device (LVAD) patients

- Immediately activate specialised teams for unresponsive LVAD patients.
- Troubleshoot device issues as a priority, following relevant protocols.
- Start CPR while simultaneously attempting to restore device function if multiple rescuers are available.
- Consider delaying CPR for up to 2 min to attempt device restoration if a single rescuer is present.

Cardiac arrest in sports

- Screening as primary prevention plays an important role, but remains controversial.
- All sports and exercise facilities should undertake a risk assessment which considers the likelihood and consequences of sudden cardiac arrest and put in place mitigation strategies to reduce the risk.
- Assume cardiac arrest if collapsed during, or just after sport.
- Gain immediate and safe access to the field of play.
- Awareness programs in sports events have proven to be feasible to raise awareness amongst target groups not yet involved with cardiac arrest.

Guidelines: Special patient groups

Asthma

- Treat life-threatening hypoxia with 100% oxygen.
- Check for evidence of pneumothorax and tension pneumothorax.
- Exclude anaphylaxis as a precipitating cause.
- Provide endotracheal intubation (due to high inflation pressures).
- Consider manual decompression and disconnection from ventilator to manage dynamic hyperinflation.
- Consider ECPR in accordance with local protocols if initial resuscitation efforts are unsuccessful.

Cardiac arrest in haemodialysis patients

- Assign a trained dialysis operative to operate the dialysis machine.
- Stop dialysis and return the patient's blood volume with a fluid bolus.
- Disconnect from dialysis machine (unless defibrillation-proof) and beware of wet surfaces.
- Leave dialysis access open and use it for drug administration.
- Dialysis may be required in the early post-resuscitation period.

Resuscitation in obese patients

- Obese patients should receive standard resuscitation treatment – no deviation from standard BLS and ALS is needed.

Cardiac arrest in pregnancy

- Consider pregnancy in any collapsed woman of childbearing age.
- Pregnant and peripartum women can deteriorate to cardiac arrest anywhere; medical facilities and services must be prepared for such events.
- Obstetric-specific early warning systems enable early recognition of deteriorating pregnant patients.
- Above 20 weeks gestation, relieve aortocaval compression as early as possible and maintain it throughout resuscitation. Manual left uterine displacement in maternal cardiac arrest is preferred over the lateral tilt, due to the practicalities of delivering chest compressions.
- Systematically address the 4Hs and 4Ts and seek pregnancy-specific causes of cardiac arrest, the 4Ps: **P**re-eclampsia and eclampsia, **P**uerperal sepsis, **P** lacental and uterine complications, and **P**eripartum cardiomyopathy.
- Resuscitative hysterotomy is a time-sensitive intervention. Preparation to perform the procedure should be undertaken early; it should be performed as soon as possible, at the site of cardiac arrest by a skilled team.
- Post-resuscitation care in pregnant and postpartum women requires a multidisciplinary approach.

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