1. **Scope**

1.1 The challenge for ambulance clinicians is to differentiate those patients for whom cardiac arrest is their natural end of life event, from those where there is a chance to restore life with a quality acceptable to the patient and in accordance with their wishes.

1.2 This clinical guideline aims to promote the concept of a ‘good death’ for those patients in whom resuscitation is not indicated, or would be futile, whilst providing optimum out of hospital care for patients with the chance of a positive outcome.

1.3 This guideline must be read in conjunction with current JRCALC and Resuscitation Council UK guidelines.

2. **Background and Definitions**

2.1 The management of cardiac arrest within the Trust follows the 2010 Resuscitation Council UK Guidelines.¹

2.2 Confirmation of Death is the term used by the Trust to describe the JRCALC terminology of Recognition of Life Extinct (ROLE).²
3. Confirmation of Death

3.1 Confirmation of death is the procedure whereby a Trust clinician either decides not to start resuscitation, or stops resuscitation once started.

3.2 The authority to confirm death is dependent on clinical grade, as detailed in Table 1.

3.3 Table 1 - Authority to Confirm Death by Clinical Grade:

<table>
<thead>
<tr>
<th>Conditions unequivocally associated with death</th>
<th>ACA</th>
<th>ECA</th>
<th>Student Paramedic</th>
<th>Advanced Technician</th>
<th>Paramedic</th>
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<th>Conditions when resuscitation can be discontinued without Advanced Life Support</th>
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<th>Advanced Technician</th>
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<th>Conditions when resuscitation can be discontinued following Advanced Life Support (ALS)</th>
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<th>ECA</th>
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<th>Advanced Technician</th>
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3.4 Conditions Unequivocally Associated with Death

3.4.1 The following conditions are unequivocally associated with death in all age groups; in all other cases resuscitation should be commenced and the facts pertaining to the arrest established:
- ▲ Massive cranial and cerebral destruction;
- ▲ Hemicorporectomy or similar massive injury;
- ▲ Decomposition/putrefaction;
- ▲ Incineration;
- ▲ Hypostasis;
- ▲ Rigor mortis;
- ▲ Foetal maceration.

3.4.2 Appendix 6 provides a timeline of features that occur post death such as algor mortis, livor mortis (post mortem hypostasis) and rigor mortis, so that Trust clinicians are informed of their characteristics and the factors which can influence their onset and presentation.
3.5 Conditions When Resuscitation can be Discontinued Without ALS

3.5.1 Resuscitation can be discontinued without ALS if any of the following are present, in all age groups:

▲ The presence of a DNAR (Do Not Attempt Resuscitation) order or an Advanced Decision to Refuse Treatment (Living Will) that states the wish of the patient not to undergo attempted resuscitation. A DNAR decision does not override clinical judgement in the event of a reversible cause of the patient’s cardiac / respiratory arrest e.g. patient choking, anaphylaxis or trauma.

▲ Patient in the final stages of a terminal illness where death is imminent and unavoidable and CPR would not be successful, but for whom no formal DNAR decision has been made;

▲ Efforts would be futile as all of the following exist together:
  ● 15 minutes since the onset of collapse;
  ● No bystander CPR prior to arrival of the ambulance;
  ● Absence of any exclusion factors (drowning, hypothermia, poisoning, pregnancy);
  ● Asystole rhythm for >30 seconds on the ECG monitor screen;

▲ Submersion for longer than 1.5hrs. (See Para 3.5.2)

3.5.2 In the case of patients who have experienced submersion, resuscitation should be commenced where any of the following are present:

▲ Possibility of their patient being able to breathe from a pocket of air while underwater.

▲ Anyone showing any signs of life on initial rescue.

▲ Those whose airway has been only intermittently submerged for the duration of their immersion, e.g. Those wearing lifejackets but in whom the airway is being intermittently submerged, provided the body still has a reasonably fresh appearance.

3.6 Conditions When Resuscitation can be Discontinued Following ALS

3.6.1 Resuscitation can be discontinued once ALS has commenced if all of the following exist together:

▲ Suspected medical/cardiac cause;

▲ Patient remains in asystole or agonal (broad idioventricular rhythm with a rate of 10 or less per minute, as defined in Para 3.6.4) rhythm for at least 20 minutes;

▲ No exclusion criteria are present (Para 3.6.2).
3.6.2 Resuscitation cannot be discontinued if any of the following exclusion criteria are present:
- Maternity - Manage in accordance with JRCALC/Trust guidelines;
- Trauma - Manage in accordance with JRCALC/Trust guidelines;
- Hypothermia - Manage in accordance with JRCALC/Trust guidelines;
- Suspected cause of drowning or drug induced cardiac arrest - Once resuscitation has commenced, the patient must be conveyed to an Emergency Department.

3.6.3 For the purpose of cessation of resuscitation, Advanced Life Support is defined as:
- A registered clinician in attendance (Nurse, Paramedic, ECP, Doctor);
- Reversible causes have been considered;
- Airway is patent, using an airway device as necessary;
- Ventilation is effective;
- If indicated defibrillation has been delivered;
- Drug therapy is administered in accordance with resuscitation guidelines.

3.6.4 An agonal rhythm is a terminal event in the dying process, caused by the death of the myocardium. An agonal rhythm does not respond to treatment and is usually the last rhythm before asystole. Resuscitation may only cease under the agonal rhythm criteria in Para 3.6.1 when the senior clinician on-scene can confirm the presence of a broad idioventricular rhythm with a rate of 10 or less per minute. If there is any doubt as to whether the rhythm is agonal or PEA (e.g. the complexes are narrow or faster than 10 per minute), the patient must be managed as a PEA arrest. The following points are provided as a general guide to the presentation of an agonal rhythm, which is also pictured in Figure 1.
- Rate: Pattern tends to slow as the myocardium progressively dies. Often under 10 complexes per minute;
- Rhythm: Regular or irregular;
- Atrial conduction: P waves are usually not present;
- Ventricular conduction: QRS complexes are wide and often bizarrely shaped. The QRS complexes become broader with a decreasing amplitude over time.

3.6.5 Figure 1 - Example of Agonal Rhythm
3.7 Cessation Outside of Trust Guidance
3.7.1 Cessation of resuscitation at scene outside of the criteria may occur if agreed by a Doctor who takes responsibility for the decision, and whose details are recorded on the PCR. Where present on-scene, the Doctor must annotate the rationale for the decision on the PCR.

3.7.2 Where a Doctor is not available, the Senior Clinical Advisor On-call may be contacted to discuss the situation. The Senior Clinical Advisor may authorise the cessation of resuscitation outside of normal Trust guidance. The call will be undertaken on a recorded line, and their details must be recorded on the PCR.

3.8 Actions Following Confirmation of Death
3.8.1 Deceased Children
All deceased children must be transported to an Emergency Department, unless instructed otherwise by a Senior Police Officer. In cases where a child is left at the scene to facilitate a police investigation, the Trust will transport the body to an ED when subsequently requested to do so by the police.

3.8.2 Following an adult death in a public place:
▲ Contact Clinical Hub to request attendance of police;
▲ Do not move the body;
▲ Complete Trust documentation;
▲ Remain on scene until released by police;
▲ Conveyance of body by ambulance should only be carried out in exceptional circumstances;
▲ If confirmation of death is made when the patient is already in the ambulance and the ambulance clinician decides to convey deceased to hospital, advise Clinical Hub and request police to attend destination hospital. On arrival at hospital follow local procedures for handover of a deceased patient. The default is to handover to the Emergency Department. Ensure copy of Confirmation of Death form and PCR are included in handover process.

3.8.3 Following an adult expected death in a non-public place:
▲ Police would not normally be required to attend provided end of life arrangements can be confirmed;
▲ Liaise with family/carer to contact preferred funeral director;
▲ Notify Clinical Hub that police are not required to attend. Notify patient’s GP according to local mechanisms;
▲ The body may be left in the care of a responsible person to await the arrival of the funeral director.
3.8.4 Unexpected adult death in a non-public place:
▲ Police must be requested to attend in their capacity as coroner’s representatives – contact via Clinical Hub;
▲ If no suspicious circumstances, ambulance clinician should consider the need to remain on scene once confirmation of death procedure has been completed, if the body may be left in the care of a responsible person;
▲ Consider the needs of the bereaved; if well supported it may be appropriate to complete all documentation and withdraw from scene;
▲ Where appropriate provide copy of bereavement leaflet;
▲ When leaving scene before arrival of police, ensure a copy of the PCR and Confirmation of Death form is left.

3.8.5 If suspicious circumstances are suspected:
▲ Minimise contamination of scene;
▲ Contact Clinical Hub to request attendance of police;
▲ Complete Trust documentation;
▲ Remain on scene until released by police.

3.8.6 It is the responsibility of the police to inform relatives that are not present of the death of a person attended by the ambulance service.

4. Resuscitation
4.1 Increasing the Effectiveness of Resuscitation
4.1.1 In the majority of out of hospital cardiac arrests, the best chance of return of spontaneous circulation is achieved by carrying out the resuscitation attempt at the scene of the collapse. Research suggests that CPR is significantly less effective when moving a patient to an ambulance and during conveyance to hospital.

4.1.2 The interventions which increase the likelihood of ROSC most significantly are good quality chest compressions and defibrillation. These interventions take precedence over all other procedures.

4.1.3 A solo responder should not interrupt chest compressions for any reason other than to deliver ventilations or defibrillate the patient.

4.1.4 IV access, drug delivery and advanced airway management require two or more responders. While these procedures are performed, interruptions to chest compressions must be kept to an absolute minimum.
4.2 Adult Basic and Advanced Life Support

4.2.1 Adult basic and advanced life support must be performed in accordance with Resuscitation Council UK Guidelines (2010) as detailed in Appendix 1 and 2.

4.2.2 On confirmation of cardiac arrest, if the patient does not meet the conditions unequivocally associated with death, DNAR, ADRT or terminal illness, the first action is to apply defibrillation pads and ascertain the presenting rhythm.

4.2.3 When two responders/clinicians are present, one operator should commence uninterrupted chest compressions until the defibrillator pads are attached to the patient.

4.2.4 If rhythm is shockable, then defibrillate and follow ALS guideline. If rhythm is non-shockable and patient does not meet criteria to discontinue resuscitation without ALS, then continue CPR and follow appropriate ALS guideline.

4.2.5 Adult Chest Compressions:

▲ Compress the chest at a rate of 100-120 per minute. Compression rate refers to the speed at which compressions are given, not the total number delivered in each minute;
▲ Each time compressions are resumed, place your hands without delay ‘in the centre of the chest;
▲ Ensure the full compression depth of 5-6 cm is achieved;
▲ Allow the chest to recoil completely after each compression;
▲ Take approximately the same amount of time for compression and relaxation;
▲ Minimise interruptions in chest compressions;
▲ Combine compressions with ventilations at a ratio of 30:2;
▲ Rotate carrying out of chest compressions to avoid fatigue and to help maintain quality of CPR.

4.2.6 Adult Airway and Ventilation:

▲ Each inspiration phase of ventilation should be delivered over 1 second.
▲ There should be a pause of no longer than 5 seconds between sets of chest compressions to deliver the ventilations;
▲ Manage the airway using a stepwise approach, in line with Clinical Guideline (CG03) - Airway Management;
▲ Where the cause of the arrest is thought to be due to asthma, COPD or an anaphylactic reaction and there is resistance to ventilation, consider the benefit of early intubation and utilise the T-piece as indicated in Clinical Guideline (CG22) - T-Piece Nebulisation;
If the airway is secured with an endotracheal tube, the tube verification procedure detailed in Clinical Guideline (CG03) - Airway Management must be completed;

**ETCO₂ monitoring must be applied to all patients who are ventilated according to (CG11) - End Tidal CO₂ Monitoring.**

If airway is secured with an supraglottic airway (with adequate seal) or endotracheal tube, continue chest compressions uninterrupted at a rate of 100-120 per minute (except for defibrillation or further assessment as indicated);

- Ventilate 10 - 12 times per minute; avoid hyperventilation;

- Add supplemental oxygen as soon as possible, provided this does not adversely impact on performing chest compressions.

### 4.2.7 Adult Defibrillation

- Chest compressions should be stopped for the minimum time necessary to interpret the heart rhythm;

- To minimise rhythm analysis time, ambulance clinicians trained to recognise a shockable rhythm (Advanced Technician, Nurse, Paramedic, ECP and Doctor) must use the defibrillator in manual mode;

- To maximise the effectiveness of chest compressions, improve coronary perfusion pressure and minimise the pre-shock pause, chest compressions must continue whilst the defibrillator is charging. The rapid charging time of the Zoll AED Pro may prevent this from occurring. Due to the device set-up, this procedure cannot currently be followed whilst using semi-automatic defibrillators, or those in advisory mode.

- For safe practice, the operator delivering chest compressions must be the only one to press the shock button;

- Following defibrillation, immediately resume CPR for two minutes without re-assessing the rhythm or feeling for a pulse.

### 4.2.8 Adult Drugs:

- Delivery of drugs via a tracheal tube is no longer recommended;

- Obtain IV access;

- If IV access cannot be achieved, consider obtaining IO access inline with Clinical Guideline (CG13) - Intraosseous Access;

- First dose of Adrenaline 1:10,000 (1mg) should be administered in accordance with JRCALC and subsequent doses given every 3-5 minutes whilst the patient remains in cardiac arrest;

- Atropine is no longer used in asystole or pulseless electrical activity;

- All IV/IO drugs should be flushed with at least 20mls normal saline. This may be achieved by setting up an intravenous infusion of 500ml normal saline.
4.2.9 Refractory / Persistent Ventricular Fibrillation:
- Administer amiodarone (300mg) after the third shock (post adrenaline). A further dose of 150mg may be given if the patient remains in VF/VT after the 5th shock;
- Consider early conveyance to ED if unable to manage reversible cause on scene;
- Consider alternative pad position e.g. Anterior/posterior;
- If ROSC achieved and patient suffers subsequent further arrest with shockable rhythm, defibrillation count is restarted;
- If hypothermic, deliver a maximum of three shocks and a single dose of adrenaline.

4.2.10 Witnessed Monitored Arrest:
- A pre-cordial thump may be administered only when a patient experiences a witnessed VT/VF arrest whilst connected to an ECG monitor;
- If the patient is already connected to a defibrillator, a shock must be delivered. Consider delivering up to three stacked shocks before starting chest compressions.

4.3 Hypothermia
4.3.1 Accidental hypothermia is often under-diagnosed in temperate climates. In a normal person hypothermia can develop during exposure to cold environments, in people who have been immobilised or immersed in cold water. In the elderly and very young where thermoregulation is impaired hypothermia can follow a very mild insult. The risk of hypothermia is also increased by exhaustion, illness, injury, neglect, reduced level of consciousness or when drugs or alcohol have been ingested.

4.3.2 Severe hypothermia is associated with the depression of cerebral blood flow and oxygen requirement, reduced cardiac output and decreased arterial pressure. Patients can appear to be clinically dead because of significant depression of brain and cardiovascular function, but full resuscitation with intact neurological recovery is possible. The patients peripheral pulses and respiratory effort may be difficult to detect, therefore resuscitation should not be withheld based on clinical presentation.

<table>
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<tr>
<th>Mild</th>
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<th>Severe</th>
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<tr>
<td>&lt;35°C</td>
<td>28-32°C</td>
<td>&lt; 28°C</td>
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4.3.3 Management:
▲ Palpate a major artery, look at the ECG and look for signs of life before concluding that there is no cardiac output.
▲ If the patient is pulseless start chest compressions and ventilations at the same rate as for normothermic patients.
▲ Hypothermia can cause stiffness of the chest wall, making chest compressions and ventilations difficult.
▲ Once resuscitation has been started measure a temperature early.
▲ It is important to prevent further heat loss from the patient's body core, by removing wet garments, protecting against heat loss and wind chill by using blankets and insulating equipment.
▲ Maintain the horizontal position and avoid rough movement and excessive activity.

4.3.4 The hypothermic heart may be unresponsive to cardio-active drugs and defibrillation, therefore:
▲ Do not repeat adrenaline and other drugs until the core temperature returns to normal (above 35°C) then use the standard drug protocols.
▲ Give the drugs via a large proximal vein or by intraosseous access (preferably proximal humeral site, if landmark is easily identified).
▲ In a hypothermic patient resuscitation should not be withheld unless the cause of the cardiac arrest is clearly attributable to fatal illness, prolonged asphyxia, lethal injury or the chest is incompressible.

DO NOT STOP RESUSCITATION IN THE PRE HOSPITAL SETTING.

4.4 Hyperthermia
4.4.1 Hyperthermia occurs when the body's ability to thermo-regulate fails and core temperature exceeds that normally maintained by homeostatic mechanisms. Hyperthermia occurs when body metabolic heat production or environmental heat load exceeds the body's normal heat loss capacity, or when there is impaired heat loss.

4.4.2 When managing the hyperthermic patient in cardiac arrest: Follow standard procedures for basic and advanced life support and cool the patient rapidly to a temperature of 39°C. Attempt defibrillation if required, while continuing to cool the patient.

4.4.3 Prognosis is poor when compared to normothermic cardiac arrests. High body temperature is capable of producing irreversible brain damage and the risk of unfavorable neurological outcome increases for each degree of body temperature > 37C.
4.5 Drowning

4.5.1 Drowning is defined as a process resulting in primary respiratory impairment from submersion/immersion in a liquid medium and is the third leading cause of accidental death in Europe.

4.5.2 Near drowning is the survival of a drowning event which has involved unconsciousness or water inhalation, and can lead to serious secondary complications or death up to 72 hours after the event. Physiological responses to even small quantities of liquid in the lungs can cause pulmonary oedema over the following hours, which reduces their ability to exchange air leading to secondary drowning. Therefore all victims of drowning incidents should be conveyed to hospital at the earliest opportunity.

4.5.3 If possible the patient should be lifted out of the water in a prone position as hypotension may follow when lifting the patient out in an upright manner because of the relative change in pressure surrounding the body from air to water.

▲ Administer high flow oxygen
▲ Delaying the initiation of chest compressions if the patient is in cardiac arrest will reduce survival. The patients heart may be extremely slow and external cardiac chest compressions may be required.
▲ Palpation of the pulse as the sole indicator to confirm the presence or absence of cardiac arrest is unreliable, additionally use ECG and end tidal carbon dioxide to confirm cardiac arrest.
▲ If the patient is in cardiac arrest follow standard advanced life support protocols.
▲ Consider early tracheal intubation, as high pressure may be required for ventilation because of poor compliance resulting from pulmonary oedema.
▲ Regurgitation of stomach contents is common following resuscitation from drowning and should be managed in the same way as for any cardiac arrest in most drowning incidents patients will aspirate small amounts of water, and this is absorbed into the central circulation.

▲ DO NOT USE ABDOMINAL THRUSTS OR TIP THE PATIENT HEAD DOWN TO REMOVE WATER FROM THE LUNGS OR STOMACH.
▲ During prolonged immersion, patient's may become hypovolaemic due to hydrostatic pressure of the water on the body. Administer IV fluids to correct hypovolaemia.
▲ If the patient is hypothermic manage as per guidance in Section 4.3
4.5.4 Post Resuscitation care:
▲ After submersion adequate ventilation should be used as the patient is at high risk of developing acute respiratory distress syndrome (ARDS).
▲ There is no difference in the management of salt and fresh water drowning.
▲ If submersion occurs in cold water (<5°C), hypothermia may develop rapidly and provides some protection against hypoxia.
▲ After resuscitation it is unclear whether further therapeutic hypothermia is beneficial. A pragmatic approach might be to continue to warm the core temperature to 32-36°C.

4.6 Opiate Overdose
4.6.1 Cardiac arrest is usually secondary to a respiratory arrest and is therefore associated with severe brain hypoxia, meaning prognosis is often poor.

4.6.2 If cardiac arrest occurs, follow standard resuscitation guidelines whilst incorporating the following recommendations;
▲ Administering naloxone is unlikely to cause harm and can be given IV, IO, IM or IN for patients aged 12 to adult 400mcg) every 3 minutes to a maximum dose of 4400mg. Administer incrementally until the patient is breathing adequately and is able to protect their own airway.
▲ Acute withdrawal from opioids can produce a state of sympathetic excess, causing arrhythmia and severe agitation, use with caution in patients suspected of opioid dependence.
▲ Resuscitation should not be withdrawn in the pre-hospital setting.

4.7 Asthma
4.7.1 Cardiac arrest in the asthmatic is often a terminal event after a period of hypoxaemia, and has been linked to:
▲ Severe bronchospasm and mucous plugging leading to asphyxia;
▲ Cardiac arrhythmias due to hypoxia, stimulant drug or electrolyte abnormalities;
▲ Dynamic hyperinflation where a gradual build up of pressure occurs which reduces venous return and blood pressure;
▲ Tension pneumothorax (often bilateral).

4.7.2 Consideration of the 4H's and 4T's will help identify these causes of cardiac arrest.
4.7.3 Management of cardiac arrest in asthma patients should follow standard protocols whilst incorporating the following recommendations:

▲ Ventilation may be difficult because of increased airway resistance, use the T-piece to support nebulisation as detailed within Clinical Guideline (CG22) T-piece Nebulisation;

▲ There is a significant risk of gastric inflation and hypoventilation of the lungs when ventilating a severe asthmatic therefore intubate the trachea early;

▲ The recommended respiratory rate (10 breathes per minute) and tidal volume should not cause dynamic hyperinflation of the lungs (gas trapping);

▲ If dynamic hyperinflation is suspected during CPR, compression of the chest wall and/or a period of apneoa by disconnecting the BVM and catheter mount from the tracheal tube, may relieve gas trapping;

▲ Look for evidence of reversible causes, specifically; Tension pneumothorax and bilateral pneumothoraces;

▲ Decompress suspected pneumothoraces;

▲ Follow standard guideline for post resuscitation care.

4.8 Anaphylaxis

4.8.1 Anaphylaxis is a severe, life threatening allergic reaction of rapid onset which results in a generalised or systemic hypersensitivity reaction. It can be recognised by rapidly developing life-threatening airway and/or breathing and/or circulation problems. All allergic reactions should be managed according to Clinical Guideline (CG04) Allergic Reactions. Should cardiac arrest occur manage the patient with the following considerations:

4.8.2 Manage following standard procedures for basic and advanced life support and consider the use of steroids, antihistamines (if not already administered) and large amounts of fluids. Prolonged resuscitation may be required.

4.8.3 In patients with angioedema and severe anaphylaxis, airway compromise may occur rapidly. Warning signs are swelling of the tongue and lips, hoarseness and oropharyngeal swelling.

4.8.4 Consider early intubation for patients in cardiac arrest, as a delay may make later attempts extremely difficult. Supra-glottic airway devices are likely to be difficult to insert as airway swelling progresses. A needle cricothyroidectomy or surgical airway (if available) may be required if intubation is not possible.
4.9 Blunt Trauma

4.9.1 Survival from traumatic cardiac arrest is correlated with duration of CPR and the time spent pre-hospitally. Prolonged CPR is associated with a poor outcome. In the pre-hospital setting, treatment should focus on high quality CPR, advanced life support and exclusion of reversible causes using the 4H’s and 4T’s approach.

4.9.2 Resuscitation should be commenced in all patients irrespective of whether the cardiac arrest was witnessed, unless the patient is clearly beyond help (e.g. nonsurvivable injury, presence of conditions unequivocally associated with death).

4.9.3 Undertake only essential life saving interventions on scene, if the patient has signs of life rapidly transfer to hospital. Do not delay for spinal immobilisation.

4.9.4 Effective airway management (using a stepwise approach) is essential to maintain oxygenation of the severely compromised trauma patient.

4.9.5 In low cardiac output conditions, positive pressure ventilation may cause further circulatory depression, or even cardiac arrest, by impeding venous return to the heart. Monitor ventilation with continuous waveform capnography (or capnometry if not available) and adjust to achieve normocarbia.

4.9.6 Treat reversible cause:

▲ Hypoxaemia – Oxygenation, ventilation;
▲ Hypovolaemia – Compressible haemorrhage (pressure, pressure dressings, tourniquets, haemostatic dressings), non-compressible (splints, conservative fluid);
▲ Tension Pneumothorax – Decompress quickly by lateral or anterior needle decompression. Consider finger thoracostomy where a clinician with critical care skills is present;
▲ Cardiac tamponade – Immediate thoracotomy where a clinician with critical care skills who is confident and competent in the procedure is on scene, or transport to MTC within 10 minutes where possible.

4.9.7 Give intravenous fluids conservatively until bleeding is controlled. In the presence of uncontrolled bleeding excessive fluid will increase bleeding.
4.9.8 In penetrating traumatic cardiac arrest, patients must be transferred rapidly to hospital because surgical intervention is often needed to treat the cause of the arrest, a ‘scoop and run’ policy is appropriate. Do not stay on scene to resuscitate.

4.9.9 In traumatic cardiac arrest, resuscitation may be discontinued once ALS has commenced if all of the following exist together:

▲ All reversible causes have been treated.
▲ Patient remains in asystole or agonal (broad idioventricular rhythm with a rate of 10 or less per minute, as defined in Para 3.6.4) rhythm for at least 20 minutes;
▲ No exclusion criteria are present (Para 3.6.2).

4.10 Paediatric Basic/Advanced Life Support

4.10.1 Paediatric life support applies to a child up to the age of puberty (excluding newborn) and should be performed in accordance with Resuscitation Council Guidelines 2010 (Appendix 3 and 4).

4.10.2 If the child does not meet the conditions unequivocally associated with death, DNAR or terminal illness proceed to the initial assessment.

4.10.3 Initial Assessment:

▲ Complete initial assessment:
  ● Check response;
  ● Open and check the airway;
  ● Check for the presence of breathing;
  ● If breathing agonal or not present deliver 5 ventilations;
  ● Re-check breathing and circulation together;
  ● If unsure about the presence of a pulse or the pulse rate is under 60 beats per minute start compressions.

▲ Evidence suggests that pulse palpation for 10 seconds is unreliable for determining the presence or absence of an effective circulation. This means that palpation of the pulse cannot be the sole determinant of the need for chest compressions. Clinicians therefore need to determine the presence or absence of ‘signs of life’, such as response to stimuli, normal breathing (rather than abnormal gasps) or spontaneous movement. They may also feel for a pulse, but if there are no other ‘signs of life’, they should only withhold CPR if they are certain there is a definite pulse.
4.10.4 Paediatric Airway and Ventilation:
▲ For ambulance clinicians trained to use a bag-valve-mask, this remains the preferred method for achieving airway control and ventilation;
▲ In most circumstances, tracheal intubation is not required in children. Manage with a step-wise approach in line with Clinical Guideline (CG03) - Airway Management.

4.10.5 Paediatric Chest Compressions:
▲ Studies have shown that chest compressions are frequently too shallow;
▲ Depth of compression should be at least one third of the anterior-posterior diameter of the chest. The mean one-third compression depth is 4cm for infants and 5cm for children;
▲ Compression rate is 100 - 120 per minute. Compression rate refers to the speed at which compressions are given, not the total number delivered in each minute.

4.10.6 Compression: Ventilation Ratios:
▲ First responders and non-frontline staff who learn only single-rescuer techniques, should use a ratio of 30 compressions to 2 ventilations;
▲ Two or more ambulance clinicians carrying out paediatric resuscitation should use a ratio of 15 compressions to 2 ventilations;
▲ Solo responder ambulance clinicians should use 15:2, unless not achieving an adequate number of compressions because of difficulty in the transition between ventilation and compression, when they should revert to 30:2.

4.10.7 Paediatric Defibrillation:
▲ Chest compressions must be delivered whilst the defibrillator is attached;
▲ If rhythm is shockable, then defibrillate and follow ALS guideline. If rhythm is non-shockable and patient does not meet criteria to discontinue resuscitation without ALS, then continue CPR and follow appropriate ALS guideline;
▲ When using a manual defibrillator, deliver a shock at 4 joules/kg. Round up to the nearest available setting when necessary;
▲ When using the Zoll Pro Defibrillator, the shock energy level is automatically determined by the device.
4.10.8 Paediatric Drugs:

▲ If venous access is not readily attainable, give early consideration to intraosseous access inline with Clinical Guideline (CG13) - Intraosseous Access;

▲ In the case of a shockable rhythm, adrenaline 10 mcg/kg (0.1ml/kg of 1:10,000) should be administered once chest compressions have been restarted after the delivery of the 3rd shock; then repeat every 3-5 minutes. For non-shockable rhythms administer as soon as IV/IO access is achieved, and repeated every 3-5 minutes whilst the patient remains in cardiac arrest;

▲ Amiodarone (5mg/kg) should be administered after the third shock (post adrenaline) in refractory VF/VT. This may be repeated one further time (5mg/kg), after the 5th shock if still in a shockable rhythm.

4.11 Newborn Resuscitation

4.11.1 A newborn is defined as a child at birth. Newborn basic life support should be performed in accordance with Resuscitation Council UK (2010) Guidelines.

4.11.2 Temperature Control

4.11.2.1 Babies are born small and wet. They get cold very easily, especially if they remain wet and in a draught. Whatever the situation it is important that the baby does not get cold at this stage. Full term babies must be dried. Remove the wet towels, and cover the baby with dry towels. Heat loss is most significant from the baby’s head, either cover with a hat or form a towel/blanket to cover the head.

4.11.3 Cord Management:

▲ For uncompromised babies, a delay in cord clamping is recommended;

▲ For compromised babies, resuscitative measures take priority;

▲ To divide the cord, apply two cord clamps securely 3cm apart and about 15cm from the umbilicus. Cut the cord between the clamps.

4.11.4 Airway and Ventilation:

▲ Assess colour, tone, breathing and heart rate;

▲ Until birth the babies lungs have been filled with fluid; aeration of the lungs in these circumstances is likely to require sustained application of pressure with a BVM for two to three seconds. These are known as inflation breaths;

▲ Give five inflation breaths and reassess;

▲ If no chest rise or increase in heart rate, provide five further inflation breaths and reassess;

▲ If no chest rise or increase in heart rate, use the two person BVM technique and reassess;
If no chest rise or increase in heart rate, reassess the airway and apply gentle suction if required. Consider the use of an advanced airway e.g. OP or SGA and re-assess;

For term infants air should be used for resuscitation at birth. If, despite effective ventilation, oxygenation remains unacceptable, use of a higher concentration of oxygen should be considered;

Pre-term babies (less than 32 weeks gestation) may not reach the same arterial blood oxygen saturations in air as those achieved by term babies, therefore oxygen should be given judiciously;

Meconium must be suctioned from the airway if the patient is unresponsive. Suction should be avoided in the conscious newborn, due to the risk of vagal stimulation.

4.11.5 Chest Compressions:

Almost all babies needing help at birth will respond to successful lung inflation with an increase in heart rate followed quickly by normal breathing. However, in some cases chest compressions are necessary;

Chest compression should be started only when you are sure that the lungs have been aerated successfully;

In babies, the most efficient method of delivering chest compression is to grip the chest in both hands in such a way that the two thumbs can press on the lower third of the sternum, just below an imaginary line joining the nipples, with the fingers over the spine at the back. If this method is not achievable, then the two finger method should be used;

The ratio of compressions to inflations in newborn resuscitation is 3:1.

4.11.6 Newborn Drugs:

The administration of drugs is not supported for newborn resuscitation, due to the challenges in delivery and skill retention.

4.12 Post ROSC Management

Successful ROSC is the first important step towards the end goal of complete recovery and discharge from hospital without neurological impairment. Post-cardiac-arrest syndrome, which comprises post-cardiac-arrest brain injury, post-cardiac-arrest myocardial dysfunction, the systemic ischaemia/reperfusion response, and persistence of the precipitating pathology, often complicates the post-resuscitation phase. The severity of the syndrome will vary with the duration and cause of the cardiac arrest.
4.12.2 The pre-hospital care of ROSC patients will contribute to the effective management of post cardiac arrest syndrome. The following guidance applies to all patients who achieve ROSC.

4.12.3 Once ROSC is achieved ambulance clinicians should remain on scene for at least 10 minutes before attempting removal, unless an intervention only available at hospital is required (e.g. intervention for suspected cardiac tamponade), or it is unsafe to remain on-scene. The recurrence rate of a shockable rhythm is at its highest during this period. During this time the following interventions should be performed:

1. Re-assess patency of airway and adequacy of breathing. Assist ventilations where required.

2. Obtain full set of observations (RR, HR, BP, SpO2, 12 lead ECG, temperature and blood glucose).

3. Titrate oxygen flow to achieve an SpO2 between 94-98%. In traumatic ROSC administer 100% oxygen.

4. Monitor end tidal CO2, aim to ventilate to achieve normocarbia of 4.0-5.7 kPa.

5. Continue to consider and address reversible causes of the initial arrest (the 4H’s and 4T’s). If present, treat arrhythmias:
   ▲ Bradycardia - Atropine according to JRCALC guidance;
   ▲ Ventricular tachycardia with a pulse - Amiodarone according to Trust PGD.

6. If patient is hypoglycaemic (blood glucose <4.0mmol) treat in accordance with JRCALC glucose guideline; blood glucose should not exceed 10mmol/l.

7. Re-check the presence of the radial pulse; if present, move to step 11.

8. If hypotensive (systolic <90mmHg / absent radial pulse) administer a fluid bolus of 250mls normal saline (administer JRCALC dose for paediatrics).
9 Approximately five minutes after the administration of the fluid bolus, re-assess patient. If a systolic greater than 90mmHg AND/OR radial pulse is present move to step 11.

10 If patient is under the age of 18 move to step 12. If patient is 18 years or over and remains hypotensive and heart rate is less than 100bpm, then prepare to administer adrenaline. Prepare a syringe of 10mcg/ml adrenaline at scene by diluting 1ml of 1:10,000 adrenaline with 9ml of saline in a 10ml labelled syringe. Administer a 1ml bolus of adrenaline 10mcg. Re-assess, and if patient remains hypotensive with a heart rate less than 100bpm, repeat boluses, until a systolic blood pressure of 80-90mmHg or higher is achieved.

11 Obtain a 12 lead ECG. If 12 lead ECG shows ST elevation in two or more anatomically contiguous leads (at least 1mm in limb leads and at least 2mm in chest leads) and history of cardiac arrest suggests cardiac cause, contact the nearest available PPCI centre and discuss whether they will accept the patient. If PPCI centre will not accept patient, record decision on the PCR and convey to nearest appropriate Emergency Department.

12 Move the patient to the vehicle, wherever possible in or as near to the horizontal position as possible.

13 If indicated, apply patient cooling as detailed in section 4.8.

14 Provide an ATMIST pre-alert to the receiving hospital.

15 If patient experiences a seizure which lasts more than 2-3 minutes or is recurrent and is unlikely to be due to hypoxia, administer IV diazemuls (or rectal diazepam in absence of IV/IO access). When administered IV, give slowly being mindful of the potential side effects of respiratory depression and hypotension. This is an additional Trust indication to standard JRCALC guidelines.

16 If the carotid pulse is lost at any point, re-enter ALS algorithm.

4.13 Post Cardiac Arrest Temperature Management

4.13.1 Following resuscitation, many patients with a return of spontaneous circulation (ROSC) have a poor neurological outcome due to hypoxic-ischemic brain injury. Mild hypothermia decreases metabolic demand, suppresses inflammation, stabilises cell membranes and reduces the release of toxic chemicals. Recent
studies on ROSC in out-of-hospital cardiac arrest recommend passive temperature management, to ensure avoidance of hyperthermia. In line with the latest evidence base, the application of active cooling using cold packs or cold saline is no longer recommended.

4.13.2 Post cardiac arrest temperature management using passive cooling must be applied to patients who fulfill all of the following inclusion criteria:

▲ Return of spontaneous circulation following cardiac arrest;
▲ Aged 1 year or over;
▲ Comatose (GCS 9 or below);
▲ Hypothermia (below 32°C) not present.

4.13.3 Apply passive cooling to prevent hyperthermia and achieve a target temperature of < 36°C:

▲ Remove insulating clothing from patient;
▲ Turn rear ambulance compartment heating off;
▲ Turn rear compartment air conditioning on (where available);
▲ Document the time that passive cooling commences in the free text section of the PCR;
▲ Due to the practicalities of removing clothing, it is recommended that passive cooling is commenced once the patient is loaded into the ambulance. Cooling may be commenced earlier at the clinician’s discretion;
▲ A blanket should be applied whilst unloading the patient at hospital to maintain modesty, but must be removed at the earliest opportunity.

5. Documentation
5.1 In line with Trust Policy, a Patient Clinical Record must be completed and annotated appropriately. A Cardiac Arrest form must also be completed for all patients where resuscitation has been commenced. A Confirmation of Death form must be completed for all cases where death is confirmed. The PCR must clearly identify the clinician who completed each airway manoeuvre, delivered defibrillation and administered each medicine.

5.2 Any deviation from this guideline must be recorded, with any potential or actual adverse event reported through the incident reporting system.
6. References


Joint Royal Colleges Ambulance Liaison Committee (2011) Cardiac Supplement 2010. JRCALC


Appendix 1 - Adult Basic Life Support

Unresponsive?

Shout for help

Open airway

NOT BREATHING NORMALLY

30 chest compressions

2 rescue breaths
30 compressions

Adapted from the Resuscitation Council (UK) algorithm.
Appendix 2 - Adult Advanced Life Support

Unresponsive? Not breathing or only occasional gasps

CPR 30:2
Attach defibrillator / monitor
Minimise interruptions

Assess rhythm

Shockable (VF / Pulseless VT)

1 Shock
Immediately resume CPR for 2 min
Minimise interruptions

Non-Shockable (PEA / Asystole)

Return of spontaneous circulation

Deliver post-ROSC management as detailed in Section 4.12

Immediately resume CPR for 2 min
Minimise interruptions

During CPR
- Ensure high-quality CPR: rate, depth, recoil;
- Plan actions before interrupting CPR;
- Give oxygen;
- Consider advanced airway and capnography;
- Continuous chest compressions when advanced airway in place;
- Vascular access (intravenous, intraosseous);
- Give adrenaline every 3-5 min;
- Correct reversible causes.

Reversible Causes
- Hypoxia;
- Hypovolaemia;
- Hypo / hyperkalaemia / metabolic;
- Hypothermia
- Thrombosis - coronary or pulmonary;
- Tamponade - cardiac;
- Toxins;
- Tension pneumothorax.

* Amiodarone (300mg) should be administered after the third shock (post adrenaline) in refractory VF/VT, with a further 150mg dose given if the patient remains in VF/VT after the 5th shock.

Adapted from the Resuscitation Council (UK) algorithm.
Appendix 3 - Paediatric Basic Life Support

Paediatric Basic Life Support
(Healthcare professionals with a duty to respond)

- **Unresponsive?**
  - **Shout for help**
  - **Open airway**
  - **NOT BREATHING NORMALLY**
    - **5 rescue breaths**
    - **NO SIGNS OF LIFE?**
      - **15 chest compressions**
      - **2 rescue breaths 15 compressions**

This algorithm shows a 15:2 ratio which should only be used by health care professionals working in teams.

Adapted from the Resuscitation Council (UK) algorithm.
Appendix 4 - Paediatric Advanced Life Support

Unresponsive? Not breathing or only occasional gasps

CPR (5 initial breaths then 15:2) Attach defibrillator / monitor Minimise interruptions

Assess rhythm

Shockable (VF / Pulseless VT)

1 Shock 4J / kg

Immediately resume CPR for 2 min Minimise interruptions

Return of spontaneous circulation

Non-Shockable (PEA / Asystole)

Deliver post-ROSC management as detailed in Section 4.12

Immediately resume CPR for 2 min Minimise interruptions

During CPR
- Ensure high-quality CPR: rate, depth, recoil;
- Plan actions before interrupting CPR;
- Give oxygen;
- Vascular access (intravenous, intraosseous);
- Give adrenaline every 3-5 min;
- Consider advanced airway and capnography;
- Continuous chest compressions when advanced airway in place;
- Correct reversible causes.

Reversible Causes
- Hypoxia;
- Hypovolaemia;
- Hypo / hyperkalaemia / metabolic;
- Hypothermia.
- Tension pneumothorax;
- Toxins;
- Tamponade - cardiac;
- Thromboembolism.

* Amiodarone (5mg/kg) should be administered after the third shock (post adrenaline) in refractory VF/VT. This may be repeated one further time (5mg/kg), after the 5th shock if still in a shockable rhythm

Adapted from the Resuscitation Council (UK) algorithm.
Appendix 5 - Newborn Advanced Life Support

**Dry the baby**
Remove any wet towels and cover
Start the clock or note the time

**Assess (tone), breathing and heart rate**

**If gasping or not breathing**
Open the airway
Give 5 inflation breaths
Consider SpO₂ monitoring

**Re-assess**
If no increase in heart rate
look for chest movement

**If chest not moving:**
Recheck head position
Consider 2 person airway control
and other airway manoeuvres
Repeat inflation breaths
Consider SpO₂ monitoring
Look for a response

**When the chest is moving:**
If heart rate is not detectable
or slow (<60 min)
Start chest compressions
3 compressions to each breath

**Reassess heart rate every 30 s**
If heart rate is not detectable
or slow (<60 min)
consider venous access and drugs
Newborn resuscitation drugs are authorised for
CCPs /Doctors only.

**Acceptable pre-ductal SpO₂**
- 2 min 60%
- 3 min 70%
- 4 min 80%
- 5 min 85%
- 10 min 90%

Adapted from the Resuscitation Council (UK) algorithm.
Appendix 6 - Recognisable signs of death

Rigor mortis is post mortem stiffening of the body after death, caused by a loss of Adenosine Triphosphate (ATP) from the body’s muscles. After death, cellular respiration in organisms ceases to occur, depleting the body of oxygen used in the making of ATP. ATP is the substance that allows energy to flow to the muscles and enables them to work. Without ATP the muscles become stiff and inflexible.

Rigor mortis occurs throughout the body at the same time but the smaller muscles are affected first, such as those in the face, neck and jaw. Larger muscles are affected later. The sequence may be due to different lactic acid levels among different muscles, which is directly related to the difference in glycogen levels and different types of muscle fibres. It can start to appear from around 1-3 hours and spreads to the larger muscles and internal organs within the next four to six hours. This change is transient, meaning that it develops and then disappears. Rigor mortis is at its peak after 12-24 hours, it then dissipates over the next day or so. When rigor mortis reverses, the body returns back to a flaccid state. The muscles lose their tightness in the reverse of how they gained it; larger muscles which contracted last will lose their stiffness first.

Its onset, peak and dissipation are temperature dependent; cold environmental temperatures can significantly slow the process, whereas very warm temperatures will speed it up.

The onset of rigor mortis is also affected by the individual’s age, sex, physical condition and muscular build. Rigor mortis may not be perceivable in infants and children due to their smaller muscle mass. The intensity of rigor also depends on the person’s muscular development. The very young, very old and debilitated often have poorly developed rigor.

Rigor mortis may develop very rapidly if the body is acidotic at the time of death, for example somebody who is physically active prior to death, as their muscles will already be lacking ATP stores. In these situations rigor mortis can be almost instantaneous.
Table 1 - Onset of Rigor Mortis:

<table>
<thead>
<tr>
<th>Factors which accelerate the onset/offset of rigor</th>
<th>Factors which delay the onset/offset of rigor</th>
</tr>
</thead>
<tbody>
<tr>
<td>▲ Warm temperatures</td>
<td>▲ Obese people show rigor later</td>
</tr>
<tr>
<td>▲ Strenuous activity</td>
<td>▲ Cold temperatures</td>
</tr>
<tr>
<td>▲ Age and greater muscle mass</td>
<td>▲ Age and muscle mass – older less muscle mass</td>
</tr>
<tr>
<td>▲ Seizure activity</td>
<td>▲ Exsanguination – haemorrhage</td>
</tr>
<tr>
<td>▲ Alkaloid poisoning</td>
<td>▲ Asphyxial deaths</td>
</tr>
<tr>
<td></td>
<td>▲ Poisoning by arsenic</td>
</tr>
</tbody>
</table>

During this process the body cools (algor mortis) to equilibrate with the surrounding temperature. On average the temperature decreases by 1.5 degrees per hour so is often evident about an hour after death. It is important to remember that this cooling process will be affected by the bodies temperature before death; what is normal for the person, any illness or infection prior to death and any activity or exercise. Environmental considerations and clothing also influence this cooling process; in extremely hot conditions bodies have actually been found to warm up.

Whilst all of these post mortem changes are useful when considering the time of death of a patient, it is also equally important to consider the scene and the environment, which in turn will help in the assessment of any post mortem changes.
Figure 1 - General Time Line of the Recognisable Signs of Death:

**Immediate changes after death** - Breathing ceases, heart stops, no pulse, pallor (cessation of circulation), muscles begin to relax (primary flaccidity), body fluids released, blood begins to coagulate.

**Algor mortis** - Cooling of the body to equilibrate with surrounding temperature (average cooling 1.5 degrees per hour).

**Livor mortis (post mortem hypostasis)** - Settling of the blood due to the combined effects of cessation of the circulation, lack of blood pressure and the effects of gravity.

**Rigor mortis** - Early mild phase, small muscles first eyelids neck and jaw.

**Rigor mortis** - Mild to moderate, larger muscles, elbows, knees. Can moved or broken with gentle moderate force.

**Rigor mortis** - Fully complete, largest muscles, upper arms, thighs. Needs greater force to move, may be impossible to move.

**Decomposition** - The body becomes flaccid and the process of decomposition begins.