

CHAPTER 1

Cardiorespiratory arrest in hospital

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This chapter summarises the management of cardiac arrest in hospitals following the 2021 Resuscitation Council UK (RCUK) guidelines. All hospital medical staff should know how to respond to cardiac arrest and should receive regular training in the management of emergency events.

The appropriateness of a resuscitation attempt should be considered and discussed with patients in order that resuscitation is NOT attempted where this would be inappropriate and futile.

Background

The incidence of in-hospital cardiac arrest (IHCA) is 1–1.5 per 1000 hospital admissions annually.

The majority of in-hospital cardiopulmonary arrests present with a non-shockable rhythm: pulseless electrical activity (PEA) – 52% and asystole – 21%. Only 17% of cardiopulmonary arrests present with a shockable rhythm (ventricular fibrillation (VF) or pulseless ventricular tachycardia (pVT)). Not surprisingly the majority of these in-hospital events occur in ward areas (85%) in patients admitted with a medical complaint. It is important to recognise that signs of deterioration prior to cardiac arrest are seen in 50–80% of patients; thus, the recognition of deterioration and prevention of cardiopulmonary arrest is important.

Many NHS Trusts submit data regarding cardiopulmonary arrest to the National Cardiac Arrest Audit (NCAA) that provides quarterly reports on the incidence of confirmed cardiac arrest in patients over the age of 28 days, who were subject to a cardiac arrest call and received chest compressions and/or defibrillation. This audit compares the hospitals' observed cardiac arrest rates with all other hospitals participating in NCAA.

Initial management

Figure 1.1 shows the algorithm for advanced life support in adults. The initial response ensuring early chest compressions and early defibrillation if appropriate is key to patient survival.

Use the DRS ABC approach (Danger, Response, Shout for help).

The airway should be opened using Head Tilt, Chin Lift manoeuvre. No more than 10s should be taken to confirm cardiopulmonary arrest by a look, listen and feel for signs of normal breathing and any other signs of life. A central pulse may be palpated but must be done in conjunction with breathing checks.

Please note that agonal breathing should be considered a sign of cardiopulmonary arrest.

Once cardiopulmonary arrest is confirmed, an emergency call via 2222 should be made and resuscitation equipment accessed. If alone, leave the patient to get help and equipment.

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Adult advanced life support

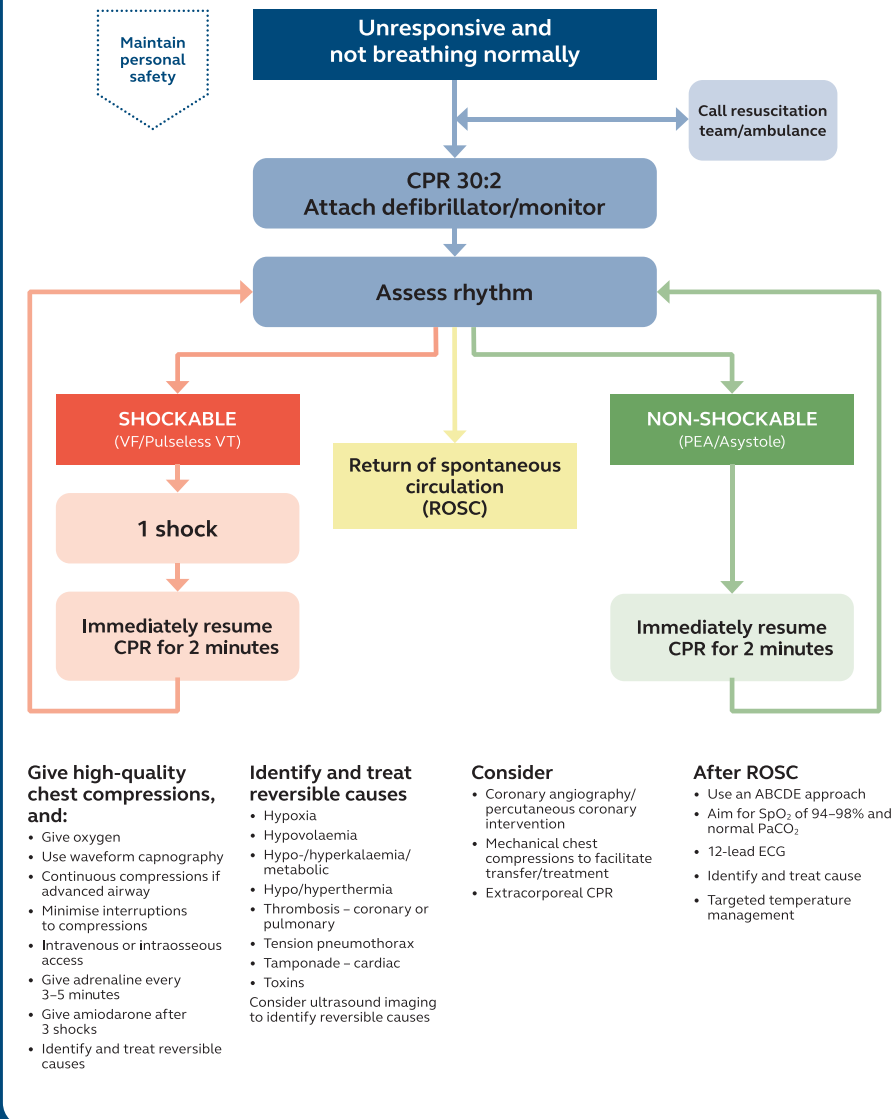


Figure 1.1 Algorithm for adult advanced life support. Source: Resuscitation Council. Reproduced with permission of the Resuscitation Council (UK).

Chest compressions

Chest compressions should commence as soon as cardiopulmonary arrest is confirmed.

Hands should be placed in the middle of the lower half of the sternum ('centre of the chest').

Chest compressions should be delivered at a rate of 100–120/min at a depth of 5–6 cm. The chest should be allowed to recoil to its normal resting position between each compression.

Once 30 compressions have been delivered, a pause should be made to allow for 2 breaths to be given if colleagues are ready with a bag-valve-mask device.

Any pause in chest compressions should be limited to less than 5 s.

Personnel delivering chest compressions must swap at least every 2 min to maintain high-quality chest compressions. If available, a cardiopulmonary resuscitation (CPR) feedback device should be used so the quality of the chest compressions can be monitored. Any pauses should be planned and limited to 5 s or less. A mechanical chest compression device should be accessed if available.

Airway and ventilation

See Chapter 105 for further information.

Use head tilt and chin lift or jaw thrust to open the airway. Use suction to clear the mouth of secretions if required.

A bag-valve-mask should be accessed, and the tubing attached to 15L of oxygen. This is a two-person technique. One operator should secure the mask to the patient's face, pushing down to establish a seal between the mask and the face, and then with fingers along the jawline lift the face into the mask while opening the airway.

The second airway assistant should squeeze the bag to deliver breaths following every 30 compressions. The breaths should be delivered over approx. 1 s and the bag only squeezed enough to provide chest rise. Over-inflation should be avoided to prevent gastric insufflation or barotrauma.

An oropharyngeal airway should be inserted if required to support airway opening.

Once resuscitation is underway, the team should consider the insertion of a supraglottic airway device (e.g. lgel) if the team is skilled in its insertion.

Endotracheal intubation should only be attempted by those with airway expertise. The decision to intubate should be made by the airway expert in conjunction with the team leader.

Once the airway has been secured with a supraglottic airway or an endotracheal tube, compressions and ventilation can be asynchronous, with compressions continuing at a rate of 100–120/min and ventilation at 10–12 breaths per minute.

Waveform capnography should be attached to the tube (lgel or endotracheal tube [ETT]), so this can be monitored during the resuscitation attempt.

Management of cardiac arrest rhythms

Once chest compressions are established, the priority is the application of a defibrillator to analyse and treat the cardiac arrest rhythm.

Defibrillator pads should be placed on dry skin; along with correct placement, it is important to ensure good skin contact taking a moment to ensure the pad is smooth and well adhered to the skin. Place one defibrillator electrode to the right of the sternum, below the clavicle. Place the second electrode in the mid-axillary line, clear of any breast tissue. Follow the pictures provided on the defibrillator pad packaging.

The defibrillator should be turned on, and as soon as a rhythm is established, chest compressions should be paused to allow for rhythm analysis.

The rhythm should be analysed as either shockable – VF, pVT or non-shockable – PEA, asystole. PEA is the most common presenting cardiac arrest rhythm in hospital.

Ventricular fibrillation/pulseless ventricular tachycardia

Once the defibrillator is attached, chest compressions should be paused to confirm the cardiac arrest rhythm, and the team leader should confirm the rhythm and verbalise this to the team.

If the rhythm is shockable and a manual defibrillator is being used, the following sequence should be followed:

Chest compressions are restarted immediately. The team leader will hand control to the defibrillator operator to deliver a safe shock.

The defibrillator operator and the person performing chest compressions should be able to see each other.

The defibrillator operator will instruct chest compressions to continue and everyone else to stand clear, ensuring that oxygen is removed (if free flowing via bag-valve-mask). The charge button is pressed, and once pressed the defibrillator operator should keep their hands away from the defibrillator until chest compressions are stopped and that person has stood clear.

Once the defibrillator is charged, the instruction is given for chest compressions to stop and that person to stand clear. A final check that all personnel are away from the patient should be made before the shock is delivered.

Once the shock is delivered, chest compressions should immediately restart.

CPR should continue for 2 min; the team leader should prepare the team for the next pause in chest compressions.

At 2 min the rhythm should be analysed again, and if the rhythm remains shockable, a further shock is delivered using the sequence mentioned earlier. Once the shock has been delivered, CPR continues for a further 2 min.

At the end of 2 min, the rhythm is analysed, and if this remains shockable, a further shock should be given repeating the sequence above. Once the third shock has been delivered and CPR recommenced, 1 mg of adrenaline 1 : 10000 IV/IO and 300 mg of amiodarone IV/IO should be delivered.

Adrenaline should be repeated every 3–5 min (alternate cycles of CPR) and a further 150 mg of amiodarone can be considered following the fifth shock.

Defibrillators and pulse checks

Staff should familiarise themselves with the type of defibrillators in use in order that these can be used safely and efficiently in cardiac arrest. Defibrillators can be used in automated external defibrillator (AED) mode or in some instances a standalone AED may be used. The emergency team and team leader should listen to the instructions provided by the AED; the delivery of the shock will depend on the shock button being pressed, so safety checks are essential prior to this action. Please note that the confirmation of cardiopulmonary arrest as described earlier is essential, once confirmed.

VF is not compatible with a pulse, so there should be no delay for a pulse check before a shock is delivered. A pulse check should only be undertaken if the rhythm is compatible with life. There should be no pause to check a rhythm or pulse following the delivery of a shock.

Pulseless electrical activity (PEA)/asystole

Once defibrillator pads are attached and the device is turned on, pause chest compressions. If the rhythm is confirmed as PEA or asystole chest compressions should immediately restart and continue for 2 min.

Adrenaline 1 mg 1 : 10000 IV/IO should be administered as soon as possible or as soon as vascular access is established. Adrenaline should be repeated every 3–5 min or every other cycle of CPR. A rhythm check must always precede the administration of adrenaline.

Pulse checks should only be undertaken if the rhythm is compatible with life.

Once the first dose of adrenaline is given in a cardiac arrest, it should be repeated every 3–5 min (every other cycle of CPR) regardless of the rhythm. Amiodarone is given after 3 shocks whether these occur sequentially or are staggered.

Reversible causes of cardiac arrest

Once cardiopulmonary resuscitation is underway, the patients' medical notes and information regarding events prior to the cardiac arrest should be ascertained by the team leader to determine the possible cause of cardiopulmonary arrest. The reversible causes are commonly referred to as the 4H's and 4T's:

- H**ypoxia
- H**ypovolaemia
- H**yperkalaemia, hypokalaemia and other metabolic disorders
- H**ypothermia
- T**hrombosis (coronary or pulmonary)
- T**ension pneumothorax
- T**amponade – cardiac
- T**oxins

If a potential reversible cause of the cardiopulmonary arrest is identified, appropriate treatment for this should commence promptly while advance life support continues. In the event of a prolonged resuscitation attempt (e.g. administration of thrombolysis for a Pulmonary Embolus [P.E.]) then a mechanical chest compression device should be sought to ensure effective chest compressions are maintained over a long period of time. It is important to ensure that staff are trained in the application of the device to ensure minimal interruption to chest compressions.

Ultrasound may be useful in the identification of some reversible causes (e.g. cardiac tamponade, P.E.). The use of this investigative technique requires training and skills in order that the operator can obtain views during a rhythm check and within 10s.

Following return of spontaneous circulation (ROSC)

A full ABCDE assessment should be carried out.

Saturations should be maintained at 94–98%; if the patient requires ongoing airway management, endotracheal intubation should be considered if not already present. Waveform capnography should continue with ventilation to achieve normocapnia.

Ensure the patient has reliable vascular access, and further lines may be needed prior to transfer. Continuous monitoring should be in place and a 12-lead ECG carried out. Fluid replacement should continue to achieve normovolaemia and achieve an systolic blood pressure (SBP) >100 mmHg.

The patient's temperature should be maintained at 32–36°. It should be noted that patients are often cool following ROSC, so take time to cover the patient and warm them if needed. Shivering should be avoided.

Any identified reversible cause should continue to be treated. The team should refer to the appropriate specialist teams (e.g. cardiology or surgeons) in order that definitive management can be provided. A discussion about the most appropriate place for ongoing management of the patient should be decided, and if transferring, this should be done by a skilled team ensuring all appropriate equipment is in place.

The team should be supported in a debrief, and the event should be documented in the patients' notes by a member of the attending resuscitation team.

Duration of a resuscitation attempt

The duration of any resuscitation attempt should be based on each individual patient case. It is important that the team leader gathers appropriate information while resuscitation attempts are ongoing to ensure that a decision is made based on the circumstances of the cardiopulmonary arrest, the patients' best interests and the likelihood of a successful outcome, achieving not only a return of spontaneous circulation but longer-term survival and quality of life.

The team leader should share their thoughts with the team, seeking agreement from all those in the resuscitation team. It is important that all members of the team are warned of the plan to stop resuscitation attempts and are given the opportunity to ask questions if needed.

In all circumstances, those people most important to the patient should be informed of the events and given the opportunity to have time with the patient. There should be a clear plan for speaking to the patients' significant others and meeting them if they are travelling to the hospital.

Decisions regarding cardiopulmonary resuscitation

The NCAA reports a survival to hospital discharge rate of 23.9% based on information collected from 175 hospitals in the United Kingdom. Patients who experience a cardiac arrest in hospital often have significant comorbidities or a disease process that will be life-limiting. CPR is not without harm; its delivery in certain patients can result in an undignified death and the delivery of a treatment that will not work. The Recommended Summary Plan for Emergency Care and Treatment (ReSPECT) is an initiative from the RCUK. ReSPECT provides a framework that enables shared decision-making in relation to emergency treatments including CPR. This plan can evolve and change over time but provides information on the patient's wishes when the person is unable to participate in decision-making. This is replacing the previous Do Not Attempt Cardiopulmonary Resuscitation (DNACPR) process in many hospitals across the United Kingdom.

Further reading

National Cardiac Arrest Audit (NCAA) Welcome to the National Cardiac Arrest Audit. <https://ncaa.icnarc.org/Home>.

Resuscitation Council UK ReSPECT – ReSPECT for healthcare professionals|resuscitation Council UK. <https://www.resus.org.uk/respect/respect-healthcare-professionals>.

Resuscitation Council UK Resuscitation guidelines 2021. Adult advanced life support guidelines|resuscitation Council UK. <https://www.resus.org.uk/library/2021-resuscitation-guidelines/adult-advanced-life-support-guidelines>.