Advanced life support resuscitation protocols

Introduction

The use of standardized protocols during resuscitation attempts should enable resuscitation team members to work effectively together. The current Resuscitation Council (UK) guidelines (Handley, 2006) are based on the recommendations that came from an international consensus on resuscitation science conference held in 2005. These guidelines are revised and updated regularly to take account of improvements in knowledge and treatments.

Treatment of patients with cardiorespiratory arrest is based on the chain of survival (*Figure 1*). The first link in the chain depicts the recognition of patients who are at risk of cardiac arrest and calling for help early. About two thirds of patients who have a cardiac arrest in hospital show signs of deterioration (e.g. low arterial blood oxygen saturations, raised respiratory rate, tachycardia, hypotension or a reduction in conscious level) in the minutes or hours before collapse. Recognizing and treating these patients may prevent cardiac arrest occurring (Hodgetts et al, 2002).

The second link is early cardiopulmonary resuscitation to buy time. Even when performed optimally, cardiopulmonary resuscitation provides only approximately 30% of the normal coronary and cerebral perfusion. Once cardiopulmonary resuscitation is started, pauses in chest compressions should be kept to an absolute minimum. The third link is early defibrillation to restart the heart. This is indicated only if the rhythm is ventricular fibrillation or pulseless ventricular tachycardia. These are the presenting rhythms that if treated are most likely to lead to survival and hospital discharge. For every minute's delay in defibrillation the chance of successful resuscitation decreases significantly (Chan et al, 2008).

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The final link is post-resuscitation care. This starts when return of spontaneous circulation occurs and aims to maximize neurological and cardiovascular recovery and to prevent a further cardiac arrest occurring.

In-hospital resuscitation

In hospital, the interventions that comprise basic life support and advanced life support overlap considerably. As soon as cardiac arrest is recognized, start chest compressions and ventilation and summon help. In UK hospitals, the number for summoning the cardiac arrest team is 2222.

The adult advanced life support algorithm

The first part of the algorithm (*Figure 2*) is the same for all patients. Make sure that it is safe to approach the patient and then assess whether the patient is responsive: speak to him/her and, if no response, shake his/her shoulders gently (shake and shout). If there is a response but the patient appears unwell, assess him/her quickly and summon help. Prompt treatment may be required to prevent cardiac arrest occurring.

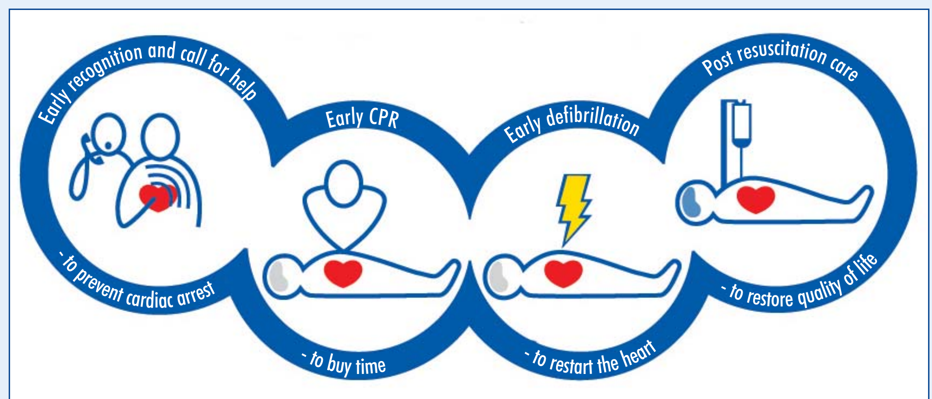
If there is no response, open the airway with a head tilt and chin lift and feel for a carotid pulse while looking for other signs of life (take no more than 10 s). Immediately after a cardiac arrest agonal gasps occur commonly – do not confuse these with normal breathing. Agonal gasps are a clear indication to perform cardiopulmonary resuscitation. If there is no pulse, no breathing and no signs of life, start cardiopulmonary resuscitation and summon help. If alone, summon help first and then commence cardiopulmonary resuscitation.

Cardiopulmonary resuscitation consists of 30 chest compressions at a rate of 100 per minute and a depth of 4–5 cm followed by two ventilations. This sequence is repeated until a defibrillator is available. The hands are placed in the middle of the chest for chest compressions. The ventilations can be delivered via a pocket mask or bag-mask system until skilled help arrives to secure the airway. Attach high-flow oxygen to the pocket mask or bag-mask system. Tracheal intubation should be attempted only by those who are skilled in this procedure and should not interrupt chest compressions except at the moment when the tracheal tube passes the cords.

If the patient is not breathing but has a pulse, give ventilations at a rate of 10 per minute. Check the pulse every minute.

As soon as a defibrillator is available, check the rhythm. The algorithm bifurcates into the treatment of shockable (ventricular fibrillation or ventricular tachycardia) or non-shockable (asystole or pulseless electrical activity) rhythms. If it is unclear whether the rhythm is fine ventricular fibrillation or asystole it is treated as asystole. This is because fine ventricular fibrillation will not be defibrillated successfully but may be converted to a more favourable rhythm (higher amplitude and frequency) with effective cardiopulmonary resuscitation.

Figure 1. The chain of survival. CPR = cardiopulmonary resuscitation.



Shockable rhythms

If the rhythm is ventricular fibrillation or pulseless ventricular tachycardia, deliver a shock immediately. Ensure that no-one is touching the patient or bed and that any freely-flowing oxygen is placed at least 1 metre away when the shock is delivered.

The initial shock should be 360 J for monophasic defibrillators and 150–200 J for biphasic defibrillators. If unsure what energy to use, select 200 J. Deliver one shock and then immediately re-start cardiopulmonary resuscitation for 2 minutes. After 2 minutes reassess the rhythm and deliver a further shock if indicated (monophasic 360 J, biphasic 150–360 J, depending on the manufacturer). Do not interrupt cardiopulmonary resuscitation before 2 minutes unless the patient shows signs of life. These 2-minute cycles are repeated until either return of spontaneous circulation is achieved or a decision to stop the resuscitation attempt has been made.

If still in ventricular fibrillation or ventricular tachycardia, give 1 mg of adrenaline before the third shock. If the adrenaline is not ready, do not delay the shock. Once adrenaline is given, repeat the dose every 3–5 minutes. In practice this means before every other shock. Amiodarone 300 mg can be given before the fourth shock.

If the rhythm has changed to asystole or pulseless electrical activity, treat as for the non-shockable side of the algorithm.

Non-shockable rhythms

If the rhythm is asystole or pulseless electrical activity, start cardiopulmonary resuscitation immediately after the rhythm check.

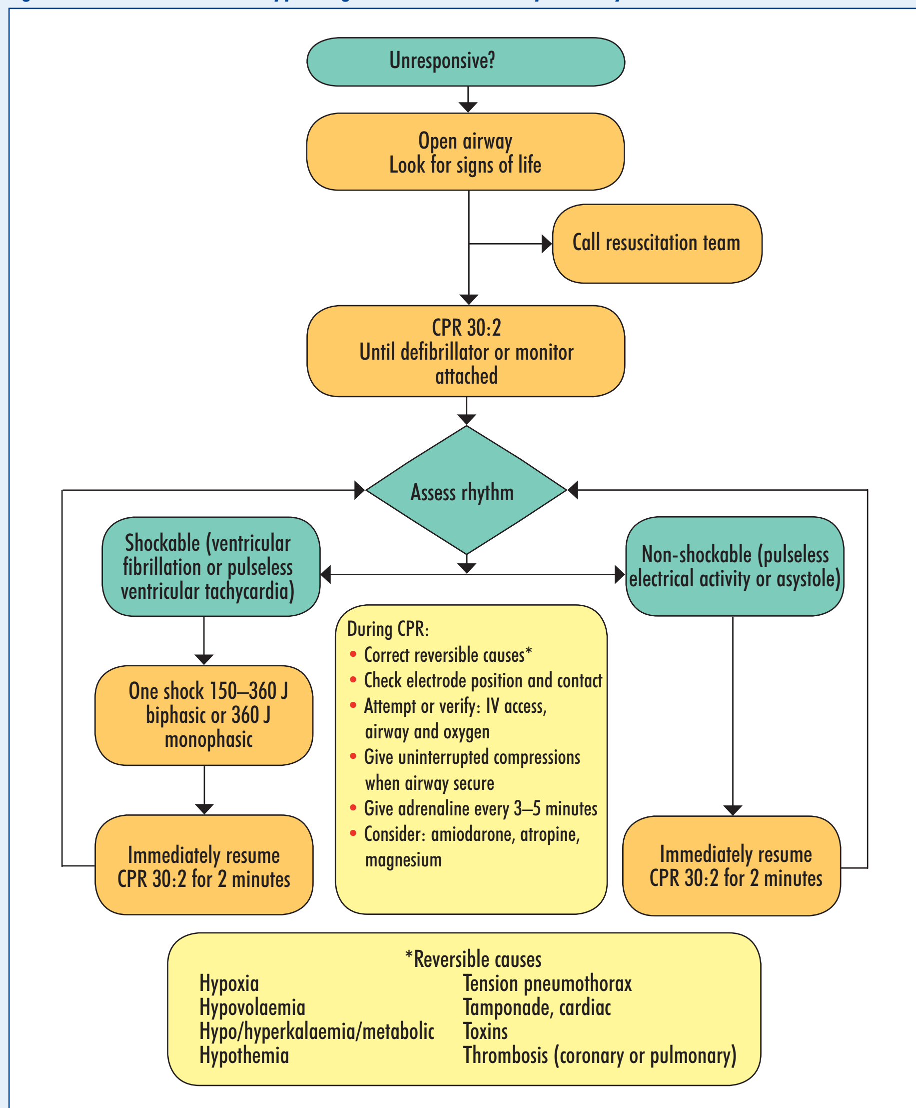


Figure 2. Adult advanced life support algorithm. CPR = cardiopulmonary resuscitation.

Give 1 mg of adrenaline and, if the rhythm is asystole or pulseless electrical activity with a rate less than 60 per minute, 3 mg of atropine. The adrenaline is repeated every other cycle. After 2 minutes repeat a rhythm check; if the rhythm is unchanged, recommence cardiopulmonary resuscitation immediately.

The cycles of 2 minutes of cardiopulmonary resuscitation and reassessment are continued until either return of spontaneous circulation or a decision is made to stop attempts at resuscitation.

During cardiopulmonary resuscitation

During the 2 minutes of cardiopulmonary resuscitation it is important to consider if there is a reversible cause of the cardiac arrest (see bottom of *Figure 2*). If any of these causes are present then correct them where possible.

Establish intravenous access if this has not been achieved already. Peripheral access is usually easier, quicker and safer than central access and avoids interruptions in cardiopulmonary resuscitation so should be attempted where possible.

Attempt to secure the airway. Tracheal intubation enables uninterrupted chest compressions but should be attempted only by those trained and experienced in the technique. If no-one with this skill is available then alternatives such as the laryngeal mask airway, I-gel, laryngeal tube or Proseal laryngeal mask airway can be attempted. Uninterrupted compressions may be possible with these devices in place, but if chest rise is inadequate, return to interrupting chest compressions to enable effective ventilation. Once the airway is secure, continue with 10 breaths and 100 chest compressions per minute.

Post-resuscitation care

If return of spontaneous circulation is achieved quickly, and the patient appears both haemodynamically and neurologically normal, he/she can be treated on a coronary care unit. All other patients will need to be admitted to an intensive care unit for ventilation and cardiovascular support. After return of spontaneous circulation, the aim of treatment is to optimize organ perfusion and to limit any secondary damage. Inducing mild hypothermia (32–34°C) for 24 hours may improve neurological

recovery, especially after an out-of-hospital ventricular fibrillation arrest (Hypothermia after Cardiac Arrest Study Group, 2002).

Decision to halt attempts at resuscitation

Many attempts at resuscitation are unsuccessful, so a decision has to be made about when to stop. There are reports of return of spontaneous circulation after prolonged resuscitation in patients with ventricular fibrillation so it is unusual to stop resuscitation attempts while in ventricular fibrillation unless further information has come to light about the patient which makes resuscitation inappropriate. After 20 minutes in asystole, it is generally considered reasonable to stop attempts at resuscitation. The decision to stop is discussed among the team members before halting.

Withholding a resuscitation attempt

There are some patients in whom it is inappropriate to attempt resuscitation. An attempt at resuscitation can be deemed futile if it will not extend life with a quality that is acceptable to the patient. The joint statement 'Decisions relating to cardiopulmonary resuscitation' from the British Medical Association, the Resuscitation Council (UK) and the Royal College of Nursing (2007) gives guidance on this subject. Senior members of the team caring for the patient should make this decision and it should be clearly documented.

While a patient does have a right to refuse treatment he/she cannot demand that a treatment be given. The decision should be discussed with the patient where possible and, with permission, also with the patient's family. The decision not to attempt resuscitation in the event of cardiac arrest should not stop the patient receiving other treatments.

Outcome

The outcome after out-of-hospital cardiac arrest remains poor, with survival to hospital discharge of approximately 3–16% (Nichol et al, 2008). In-hospital cardiac arrest survival rates are approximately 40% for ventricular fibrillation or ventricular tachycardia or 6% after asystole or pulseless electrical activity (15–20% overall). Many of those who survive have a good neurological recovery (Peberdy et al, 2003; Sandroni et al, 2007). **BJHM**

Conflict of interest: Dr J Nolan is Chairman of the Resuscitation Council (UK) and Co-chair of the International Liaison Committee on Resuscitation. He is one of the lead authors of the advanced life support guidelines compiled by European Resuscitation Council and the Resuscitation Council (UK).

British Medical Association, Resuscitation Council (UK) and Royal College of Nursing (2007) *Decisions relating to cardiopulmonary resuscitation.* A joint statement from the British Medical Association, the Resuscitation Council (UK) and the Royal College of Nursing. British Medical Association, London (www.resus.org.uk/pages/dnar.pdf accessed 6 July 2009)

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Further reading

Nolan J (2006) *Advanced Life Support.* 5th edn. Resuscitation Council (UK), London

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Nolan JP, Hazinski MF, eds (2005) International Liaison Committee on Resuscitation. 2005 International Consensus on Cardiopulmonary Resuscitation and Emergency Cardiovascular Care Science with Treatment Recommendations. *Resuscitation* **67**(suppl 1): 181–314

KEY POINTS

- Call for help early in an attempt to prevent cardiac arrest.
- Early defibrillation and effective cardiopulmonary resuscitation (compressions and ventilation) both improve survival.
- Start cardiopulmonary resuscitation promptly and limit interruptions in cardiopulmonary resuscitation.
- Once the airway is secured, chest compressions and ventilation can take place at the same time.
- Post-resuscitation care is important to maximize the chances of recovery.