

Management of cardiac arrest - review of the 2010 European Resuscitation Guidelines

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INTRODUCTION

The European Resuscitation Council (ERC) has an established 5-year cycle for updating its Cardiopulmonary Resuscitation (CPR) guidelines. The most recent update was published in October 2010, following the International Consensus on CPR Science with Treatment Recommendations (CoSTR).¹

The focus of these latest guidelines is to consolidate and fine tune the major changes introduced in the 2005 update. Emphasis is again placed upon early, uninterrupted and high quality chest compressions, while modifications to management algorithms have been kept to a minimum.

ADULT BASIC LIFE SUPPORT (BLS)

The BLS algorithm remains unchanged from the 2005

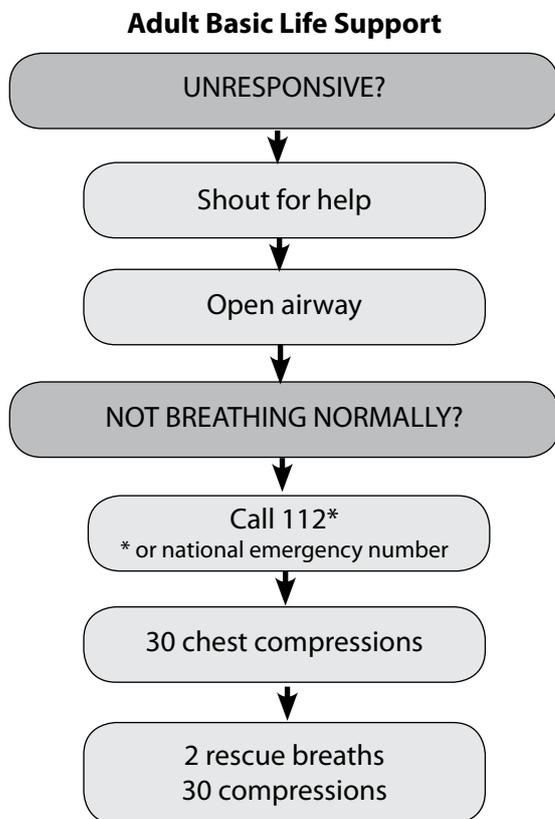


Figure 1. Adult Basic Life Support algorithm. Reproduced by kind permission of the European Resuscitation Council.

guidelines, with high quality external chest compressions (ECC) the key feature. Compressions should be at least 5cm deep and allow full recoil of the chest wall. ECC should be performed at a rate of 100 compressions per minute with a compression:ventilation ratio of 30:2.

ADULT ADVANCED LIFE SUPPORT (ALS)

Initial assessment and CPR

As before, the ALS algorithm starts with an initial assessment and commencement of CPR, followed by a division between the management of shockable (VF and pulseless VT) and non-shockable (asystole and pulseless electrical activity, PEA) rhythms.

The ALS guidelines have been changed to minimise interruptions to external chest compressions, as even brief interruptions in CPR can reduce the efficacy of subsequent defibrillation attempts. The team leader should monitor the quality of CPR and regularly rotate providers, ideally every two minutes.

There is no longer a recommendation that out of hospital cardiac arrest should be managed with two minutes of CPR prior to an attempt at defibrillation.

Defibrillation

- VF/VT is the first monitored rhythm in 25% of cardiac arrests, regardless of location. Having confirmed cardiac arrest, CPR should be continued during the location of a defibrillator and the application of adhesive pads or paddles.
- Chest compressions can be paused briefly to allow analysis of the underlying cardiac rhythm. As soon as the rhythm is identified CPR should resume.
- For shockable rhythms chest compressions should continue during charging of the defibrillator, with the adhesive pads or paddles in position on the chest. Defibrillation energy levels are unchanged from previous guidelines, 360J monophasic or 150 – 360J biphasic.
- When the defibrillator is charged chest compressions should stop and the shock delivered after a rapid safety check. Chest compressions must then immediately be resumed. Chest compressions should be interrupted for no more than 5 seconds.

Summary

This article describes the new changes to the most recent European Resuscitation Council guidance. There is increasing emphasis on maintenance of uninterrupted chest compressions. Atropine is no longer recommended for either adult or paediatric arrest.

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- Up to 3 quick, successive, ‘stacked’ shocks can be considered in VF/VT that occurs during cardiac catheterisation, immediately after cardiac surgery or in a witnessed, monitored arrest, with the patient already connected to a defibrillator.
- The precordial thump is rarely effective and now only recommended in witnessed, monitored arrests when no defibrillator is immediately available.

Drugs

Epinephrine (adrenaline) remains the vasopressor of choice in cardiac arrest. The dose is unchanged from previous guidelines at 1 mg (10ml of 1:10,000 solution), though the timing of administration has been revised.

- In VF/pulseless VT, epinephrine 1mg should be given immediately after the third shock, when chest compressions have resumed.
- In PEA/asystole epinephrine 1mg should be given as soon as IV access is obtained
- Epinephrine doses should be repeated every 3-5 minutes.

Amiodarone remains the antiarrhythmic agent of choice for VF/VT. A 300mg bolus injection should be administered after the third shock. A further bolus of 150mg may be administered for refractory VF/VT. Lidocaine 1mg.kg⁻¹ can be used if amiodarone is not available, but they should not be administered together.

The use of atropine in cardiac arrest is no longer recommended. Asystole in adults is generally a result of myocardial injury, rather than excessive vagal tone, and no evidence of benefit from atropine has been found in either asystole or PEA.

Administration of drugs via the endotracheal tube (ETT) is no longer recommended. Recent improvements in intraosseous access devices have led to this now being the alternative access of choice in cases of difficult peripheral venous cannulation.

Airway management

There is reduced emphasis on early intubation for airway management. This aims to minimise interruptions in chest compressions, and also recognizes the high failure rate of endotracheal intubation by non-expert operators. Supraglottic airway devices (SADs) are easier to insert than ETTs and do not require the interruption of chest compressions. No single SAD has been established as first choice, but successful use of the classic laryngeal mask airway (cLMA), the laryngeal tube and the I-gel have all been reported.

Endotracheal intubation should only be attempted by experienced operators, who can perform direct laryngoscopy without interrupting chest compressions. A brief pause in compressions may be required to pass the ETT through the vocal cords, but this must last no longer than ten seconds.

Waveform capnography should be used to confirm correct placement of an endotracheal tube, in conjunction with auscultation of both lung fields. Capnography also allows an assessment of the adequacy of CPR, which should ideally maintain an end-tidal CO₂ (ETCO₂) above 2kPa (15mmHg). Capnography may also give an indication of

the return of a spontaneous circulation, manifesting as a significant increase in ETCO₂.²

Ultrasound imaging

Where available, a 10 second echocardiogram, via a sub-xiphoid view, can be performed when chest compressions are paused for a rhythm check. This may aid diagnosis of the underlying, potentially reversible cause of cardiac arrest, such as pulmonary embolism, cardiac tamponade or hypovolaemia.

Absence of cardiac motion on echocardiogram during cardiac arrest has been shown to be highly predictive of unsuccessful resuscitation.³

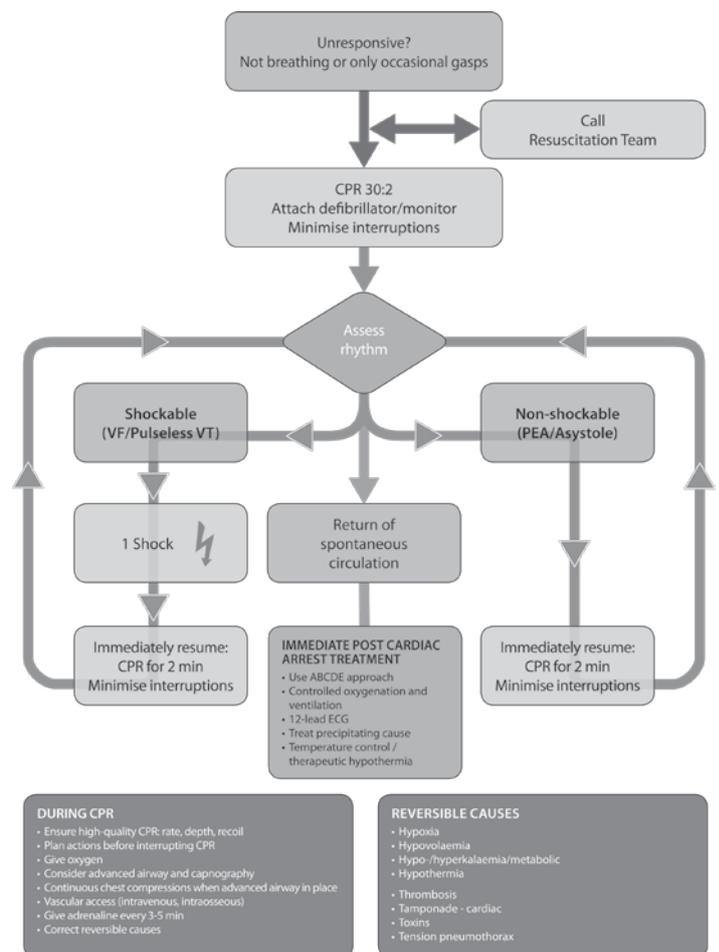


Figure 2. Advanced Life Support algorithm. Reproduced by kind permission of the European Resuscitation Council.

Periarrest arrhythmias

The algorithms for the management of tachycardic and bradycardic arrhythmias are largely unchanged from 2005. Both now share the same initial assessment of adverse clinical signs, specifically shock, syncope, myocardial ischaemia and heart failure. The subsequent recommended pharmacological and electrical therapies are unchanged.

Post resuscitation care

Post arrest brain injury, myocardial dysfunction and the systemic reperfusion response combine with the residual underlying cause of

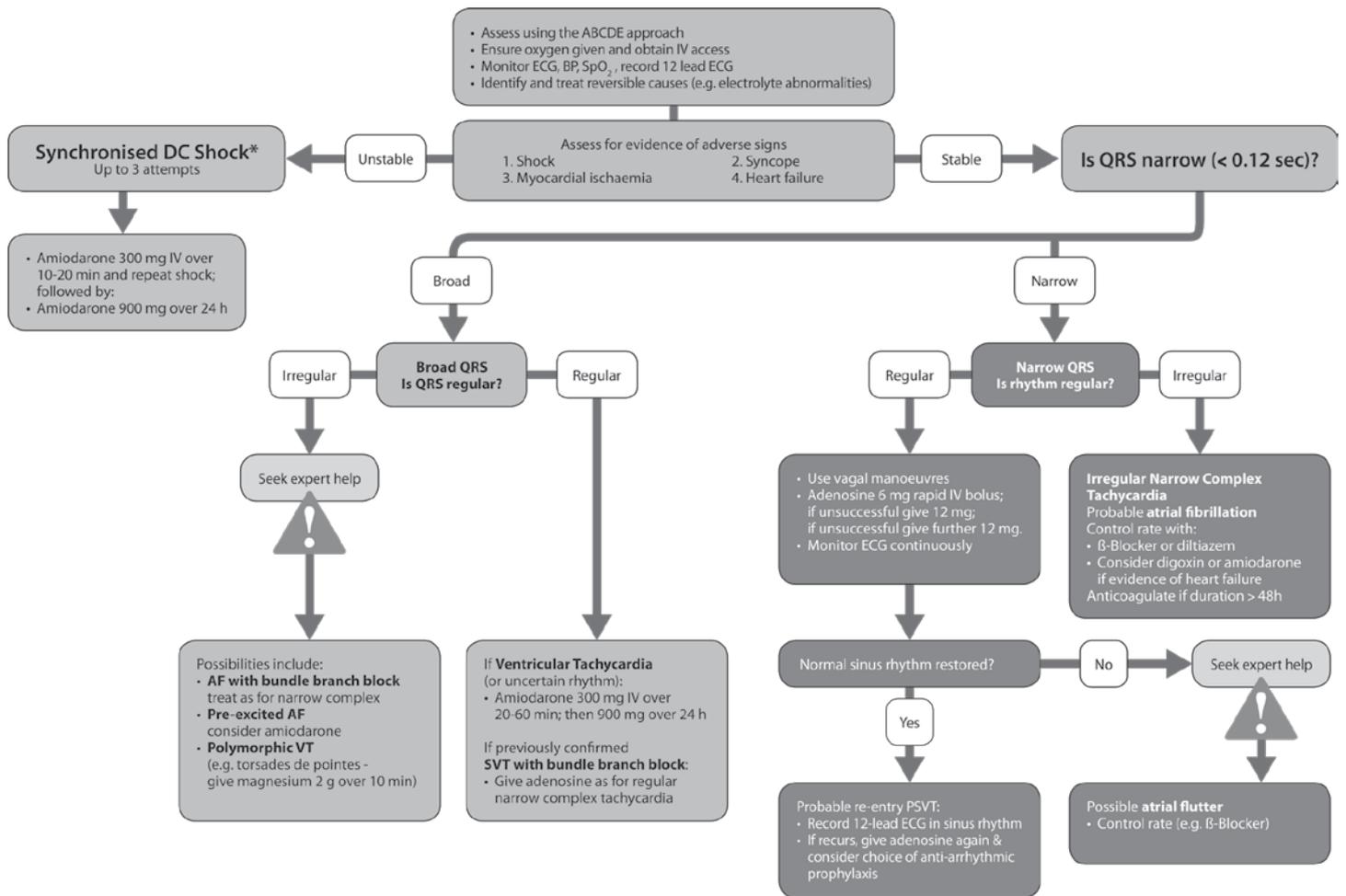


Figure 3. Tachycardia algorithm. Reproduced by kind permission of the European Resuscitation Council.

cardiac arrest to form the post cardiac arrest syndrome. The severity of this syndrome varies, depending on the cause, duration and management of the cardiac arrest. As with previous resuscitation guidelines a key aspect of improving outcome in cardiac arrest is optimising post resuscitation care.

- Hypoxaemia, hyperoxaemia and hypercarbia are associated with worse neurological outcomes and should be avoided. The inspired oxygen concentration should be titrated to maintain an SaO₂ of 94-98%.
- All post cardiac arrest patients suspected of having coronary artery disease should undergo early percutaneous coronary intervention (PCI), not just those with ECG evidence of ST elevation myocardial infarction (STEMI).
- The target range for blood glucose in post arrest patients has been relaxed after recent evidence that intensive glucose control in general ICU patients was associated with a higher 90 day mortality, and an increased risk of hypoglycaemia.⁴ Blood glucose in post cardiac arrest patient should now be maintained at less than 10mmol.l⁻¹ (180mg.dl⁻¹) and hypoglycaemia should be avoided.
- The recommended use of therapeutic hypothermia has been extended to all comatose survivors of cardiac arrest, not just those

whose arrest rhythm was VF or pulseless VT. Induction of cooling should start as soon as possible after return of spontaneous circulation (ROSC), and the patient's core temperature should be maintained at 32-34°C for 12-24 hours. While the rate of cooling should be as rapid as possible, subsequent re-warming should be achieved slowly, by no more than 0.25-0.5°C per hour, to minimise physiological instability.

PAEDIATRIC BASIC LIFE SUPPORT

The paediatric BLS algorithm is largely unchanged. However there is now a reduced emphasis on locating a central pulse for the diagnosis of cardiac arrest. Instead responders are advised to look for signs of life, and begin chest compressions if they are abnormal. Trained responders may include palpation of a pulse, but the assessment must take no longer than ten seconds.

Those trained in paediatric life support should perform CPR with a 15:2 compression:ventilation ratio. However lay responders are encouraged to use the adult ratio of 30:2 for ease of training. Compressions should be at least one third of the antero-posterior depth of the child's chest, with subsequent complete release of pressure to allow the chest wall to rebound fully. Compressions should be performed at a rate of at least 100 per minute but not greater than 120 per minute.

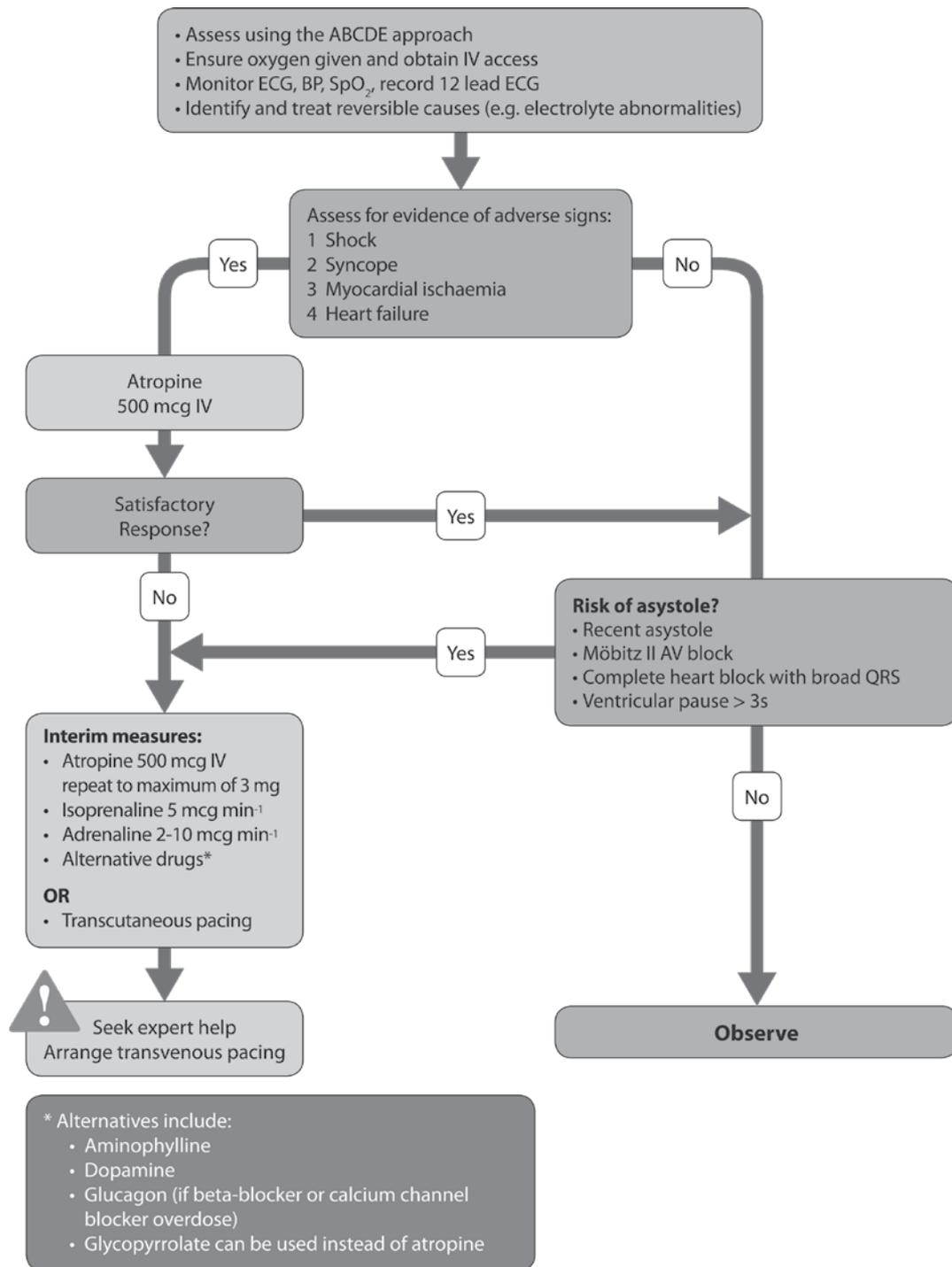


Figure 4. Bradycardia algorithm. Reproduced by kind permission of the European Resuscitation Council.

PAEDIATRIC ADVANCED LIFE SUPPORT

As with adult ALS a key aim is to minimise the interruption of chest compressions.

Defibrillation

- Chest compressions should continue while applying and charging defibrillator pads or paddles and paused only briefly to administer the shock. To maintain consistency with adult guidelines a single,

non-escalating, shock strategy is advised. Biphasic defibrillators are preferred to monophasic, but the same energy setting of 4Jkg^{-1} should be used for both.

- Automated external defibrillators (AEDs) can be used in children over 1 year of age. Ideally AED output should be reduced to 50-75J with purpose made attenuator pads, but adult energy levels may be used if these are unavailable.

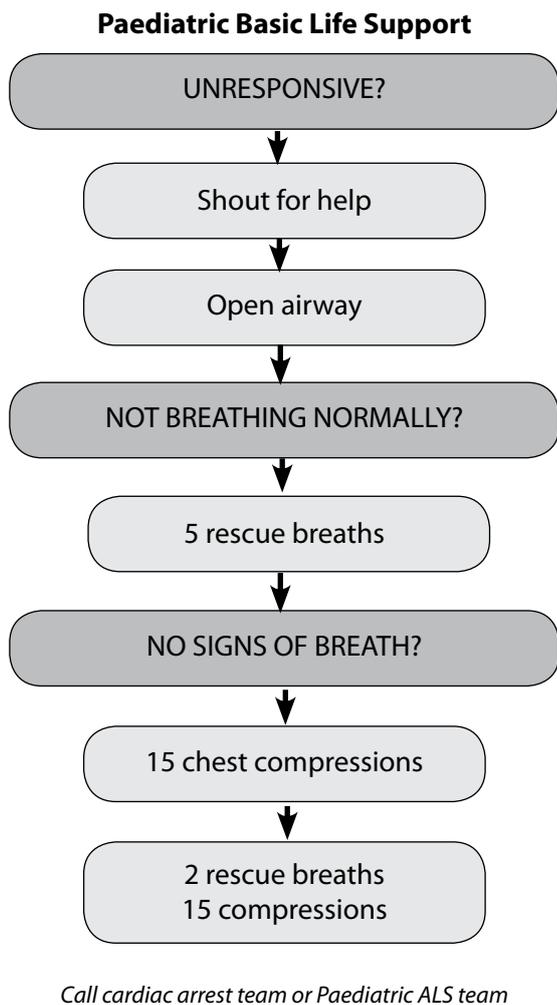


Figure 5. Paediatric Basic Life Support algorithm. Reproduced by kind permission of the European Resuscitation Council.

Airway

- Cuffed endotracheal tubes may be safely used in infants and young children, increasing the chance of first time placement of an appropriate sized tube, and improving ventilation of poorly compliant lungs. Cuff pressure should not exceed 25cm.H₂O.
- Capnography should be used to confirm ETT placement and monitor the effectiveness of CPR.

Drugs

- As with adult ALS, atropine should not be used in paediatric cardiac arrest.
- The dose of epinephrine remains unchanged at 10mcg.kg⁻¹ every 3-5 minutes.
- Amiodarone 5mg.kg⁻¹ should be given in VF/pulselessVT after the third and fifth shocks.

Post resuscitation care

The principles of management of post cardiac arrest syndrome in children are similar to those of adults:

- The inspired oxygen concentration should be titrated post ROSC to prevent hyperoxia.
- Hyperthermia has an established association with poor neurological outcome and should be avoided.
- Therapeutic hypothermia for comatose children post cardiac arrest remains unvalidated. However successful trials in adults and neonates support its extension to use in children. The current advice is that children may benefit from a similar cooling regime to that of adults. If a child with ROSC is already hypothermic they should not be actively rewarmed unless their core temperature is below 32°C.
- No specific blood glucose range is advocated but blood glucose should be monitored, and sustained hyperglycaemia or hypoglycaemia avoided.

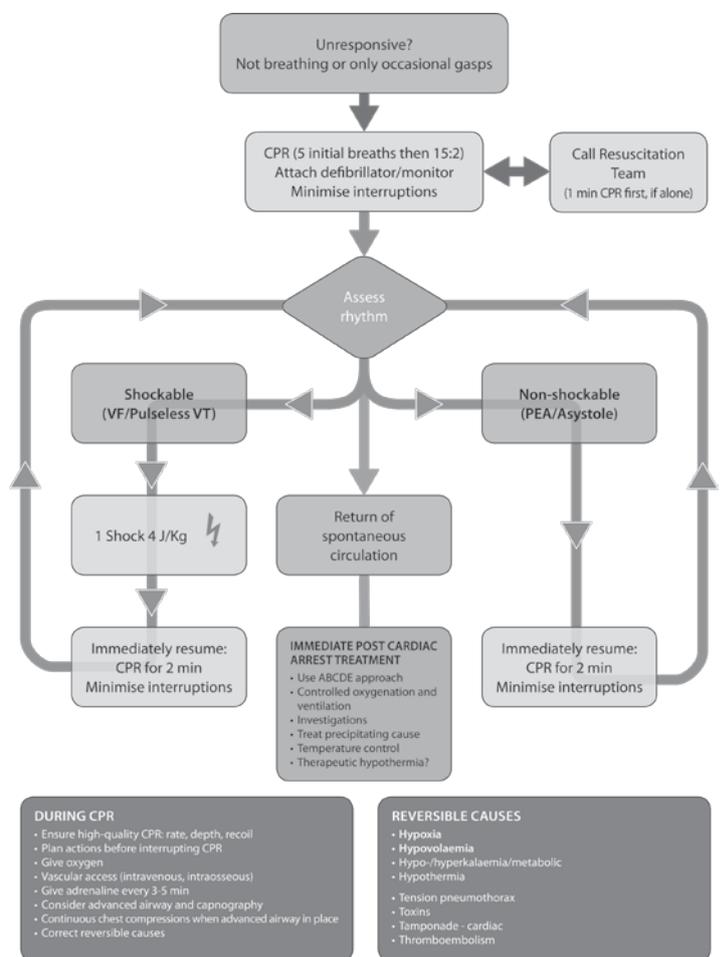


Figure 6. Paediatric Advanced Life Support algorithm. Reproduced by kind permission of the European Resuscitation Council.

RESUSCITATION OF BABIES AT BIRTH

In uncompromised newborns, cord clamping should be delayed by at least 1 minute from complete delivery. While delayed cord clamping may also benefit compromised babies, current advice is that commencing resuscitation remains the priority.

AT ALL STAGES ASK: DO YOU NEED HELP?

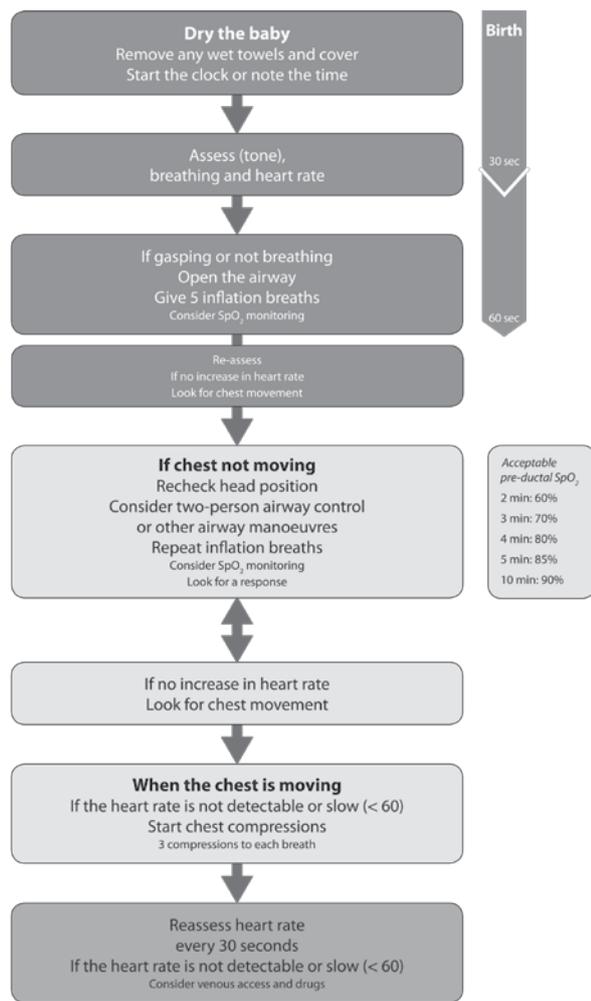


Figure 7. Newborn Life Support algorithm. Reproduced by kind permission of the European Resuscitation Council.

Air should be used for the resuscitation of term infants at birth. Oxygen supplementation can be added after initial ventilation as guided by pulse oximetry. Blended oxygen and air may be required for preterm infants born before 32 weeks gestation but both hyperoxia, and hypoxia, should be avoided.

Preterm babies of less than 28 weeks should not be dried after birth but instead immediately placed up to their necks in a plastic bag, or food wrap, and then stabilised under a radiant heater. If possible the delivery room temperature should be at least 26°C.

Rescue breaths, chest compressions and drug doses are unchanged from the 2005 guidelines.

Therapeutic hypothermia should be considered for term or near term neonates with moderate or severe hypoxic encephalopathy.

FURTHER READING

The full 2010 European Resuscitation Council guidelines can be found at: www.cprguidelines.eu/2010/

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