

Outline of the 2005 European Resuscitation Council Guidelines

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Introduction

Resuscitation guidelines are revised and updated about every 5 years and this happens because resuscitation science continues to advance and clinical guidelines must be updated regularly to reflect these developments and advise healthcare providers on best practice.

To date, the 2000 resuscitation guidelines are followed in Malta and other countries worldwide. These guidelines have been now revised by the International Liaison Committee on Resuscitation (ILCOR) and a consensus has been reached resulting in the publication of the 2005 guidelines. The ILCOR was formed in 1993 and its mission is to identify and review international science and knowledge relevant to CPR, and to offer consensus on treatment recommendations. A total of 281 experts completed 403 worksheets on 276 topics. Three hundred and eighty specialists from 18 countries attended the 2005 International Consensus Conference on Cardiopulmonary Resuscitation (CPR) Science, which took place in Dallas in January 2005. Science statements and treatment recommendations were agreed by the conference participants and the results are now the new 2005 Resuscitation Guidelines. These ILCOR guidelines will be published internationally on the 28th November 2005 for the first time. The Malta Resuscitation Council (MRC) participated in meetings of the European Resuscitation Council (ERC) where the dissemination of these new guidelines was discussed. This article will try to summarize the major changes incorporated in the new guidelines.

The chain of survival

The actions linking the victim of sudden cardiac arrest with survival are called the chain of survival. The previous chain of survival included early recognition of the emergency and activation of the emergency services, early CPR, early defibrillation and early advanced life support. The infant and child chain of survival includes prevention of conditions leading to the cardiopulmonary arrest, early CPR, early activation of the emergency services and early advanced life support. In hospital, the importance of early recognition of the critically ill patient and activation of a medical emergency team (MET) is now well accepted. Previous resuscitation guidelines have provided relatively little information on treatment of the patient during the post-resuscitation care phase. There is substantial variability in the way comatose survivors of cardiac arrest are treated in the initial hours and first few days after return of spontaneous circulation (ROSC). Differences in treatment at this stage may account for some of the inter-hospital variability in outcome after cardiac arrest. The importance of recognizing critical illness and/or angina and preventing cardiac arrest (in- or out-of-hospital), and post-resuscitation care has been highlighted by the inclusion of these elements in a *new four-ring chain of survival*. The first link indicates the importance of recognizing those at risk of cardiac arrest and calling for help in the hope that early treatment can prevent arrest. The central links in this new chain depict the integration of CPR and defibrillation as the fundamental components of early resuscitation in an attempt to restore life. The final link, post-resuscitation care, is targeted at preserving function, particularly of the brain and heart.

Adult Basic Life Support (BLS)

BLS refers to maintaining airway patency and supporting breathing and the circulation without the use of equipment other than a protective device. This section contains the guidelines for adult BLS and for the use of an automated external defibrillator (AED). It also includes recognition of sudden cardiac arrest (SCA), the recovery position and management of choking (foreign body airway obstruction).

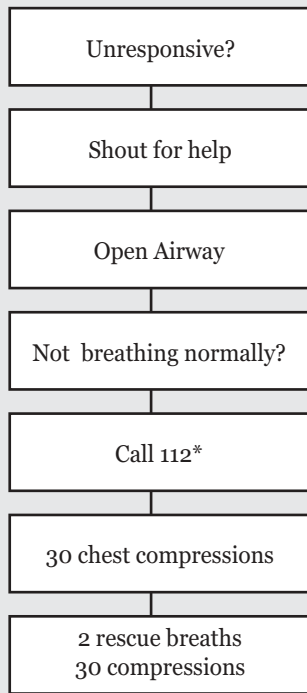
Victims of cardiac arrest need immediate CPR. Immediate CPR can double or triple survival from Ventricular Fibrillation (VF) SCA. This provides a small but critical blood flow to the heart and brain. It also increases the likelihood that a defibrillatory shock will terminate VF and enable the heart to

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Figure 1: Adult BLS algorithm



*or national emergency number

resume an effective rhythm and effective systemic perfusion. Chest compression is especially important if a shock cannot be delivered sooner than 4 or 5 min after collapse. In the first few minutes after successful defibrillation, the rhythm may be slow and ineffective; chest compressions may be needed until adequate cardiac function returns.

The Adult BLS sequence is shown in Figure 1 and one can immediately recognize major changes here. Emphasis is made on the importance of the *early* call for the Emergency Services. *Recognition of SCA is described as the presence of abnormal breathing in an unresponsive person.* The need for pulse check has been eliminated since this was found to be an inaccurate method of confirming the presence or absence of circulation. It should be emphasized that agonal gasps occur commonly in the

first few minutes after SCA. They are an indication for starting CPR immediately and should not be confused with normal breathing.

Once abnormal breathing is recognized, *chest compressions are started immediately* without giving initial rescue breaths. There are three major reasons for this. Firstly simplifying the algorithm helps in the skill acquisition and retention. Also in the first few minutes after non-asphyxial cardiac arrest the blood oxygen content remains high, and myocardial and cerebral oxygen delivery is limited more by the diminished cardiac output than the lack of oxygen in the lungs. Ventilation is therefore initially less important than the chest compressions. It is also recognized that rescuers are frequently unwilling to carry out mouth to mouth ventilations for a variety of reasons.

The importance of *increasing the number of chest compressions* is highlighted in the change of the compressions to ventilations ratio (C:V ratio). This has been increased to 30:2. This should decrease the number of interruptions in compression, reduce the likelihood of hyperventilation, simplify instruction for teaching and improve skill retention. The site for chest compressions has been simplified to *'putting the heel of the hand on the centre of the chest'* and the rate / depth remain the same (100/ min and 4-5 cm compression depth).

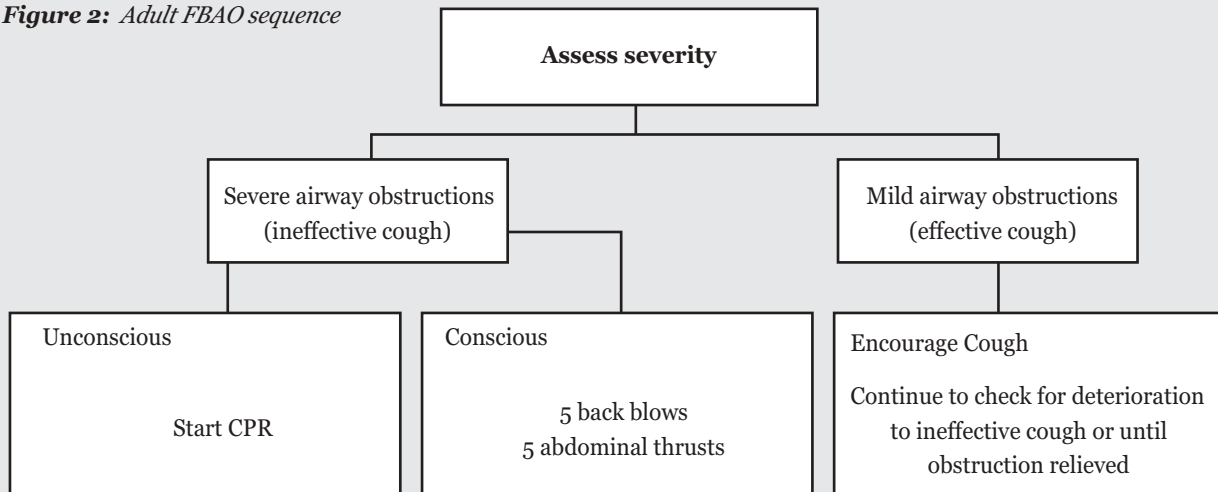
The Foreign Body Airway Obstruction (FBAO) sequence is also presented in a simpler format (Figure 2).

Use of an automated external defibrillator (AED)

The guidelines for defibrillation using automated external defibrillators (AEDs) are shown in Figure 3. Standard AEDs are suitable for use in children older than 8 y. In children between 1 and 8 y, paediatric pads or a paediatric mode are used if available; if not, the AED is used as it is. Use of AEDs is not recommended in children less than 1 y.

Immediate defibrillation, as soon as an AED becomes available, has always been a key element in guidelines and teaching, and considered of paramount importance for survival from ventricular fibrillation. This concept has been challenged

Figure 2: Adult FBAO sequence

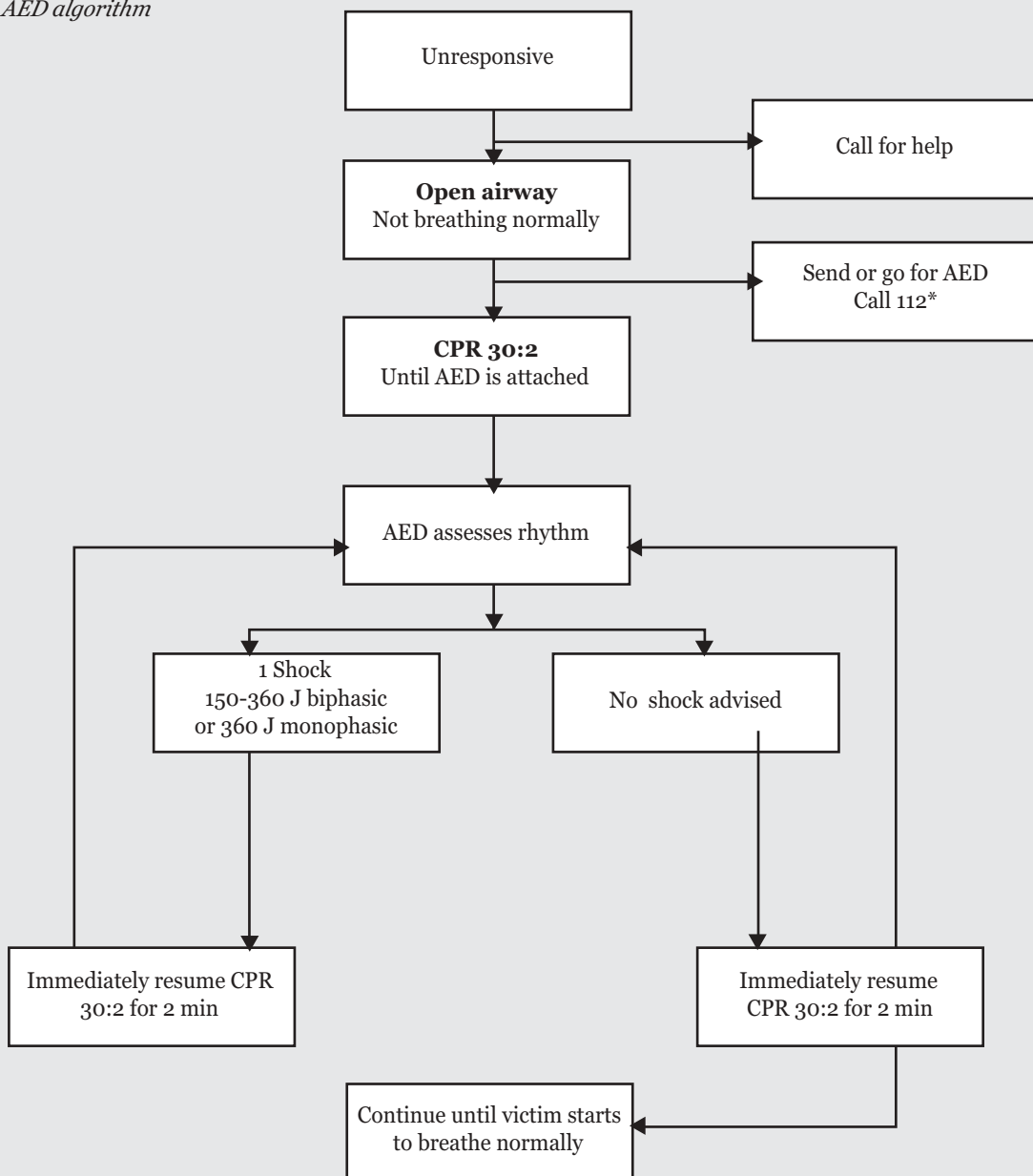


because evidence suggests that a period of chest compression before defibrillation may improve survival when the time between calling for the ambulance and its arrival exceeds 5 min. However, in all the studies, CPR was performed by paramedics who protected the airway by intubation and delivered 100% oxygen. It is also unlikely, in the majority of cases of out-of-hospital cardiac arrest, that the delay from collapse to arrival of the rescuer with an AED will be known with certainty. For these reasons, these guidelines recommend an immediate shock, as soon as the AED is available. The importance of early uninterrupted external chest compression is emphasized.

The guidelines also stress that CPR plus defibrillation within 3–5 min of collapse can produce survival rates as high as 49%–75% and that each minute of delay in defibrillation reduces the probability of survival to discharge by 10%–15%. The *major changes* are:

1. a single shock only, when a shockable rhythm is detected
2. no rhythm check, or check for breathing or a pulse, after the shock
3. a voice prompt for immediate resumption of CPR after the shock (giving chest compressions in the presence of a spontaneous circulation is not harmful)
4. 2 min for CPR before a prompt to assess the rhythm, breathing or a pulse is given.

Figure 3: AED algorithm



*or national emergency number

Adult Advanced Life Support (ALS)

The 2005 ERC ALS guidelines adhere to the same general principles as previous guidelines, but incorporate some important changes, particularly in relation to defibrillation, the timing of defibrillation in relation to external chest compression, the number of shocks that should be delivered and the recommendations for defibrillation energy.

With outcome from cardiac arrest so poor, there is also greater emphasis on the recognition and prevention of cardiac arrest. Recommendations are made for medical emergency teams (MET) or outreach teams that respond to patients with acute physiological deterioration as well as those in cardiac arrest. Strategies that may prevent avoidable in-hospital cardiac arrests are:

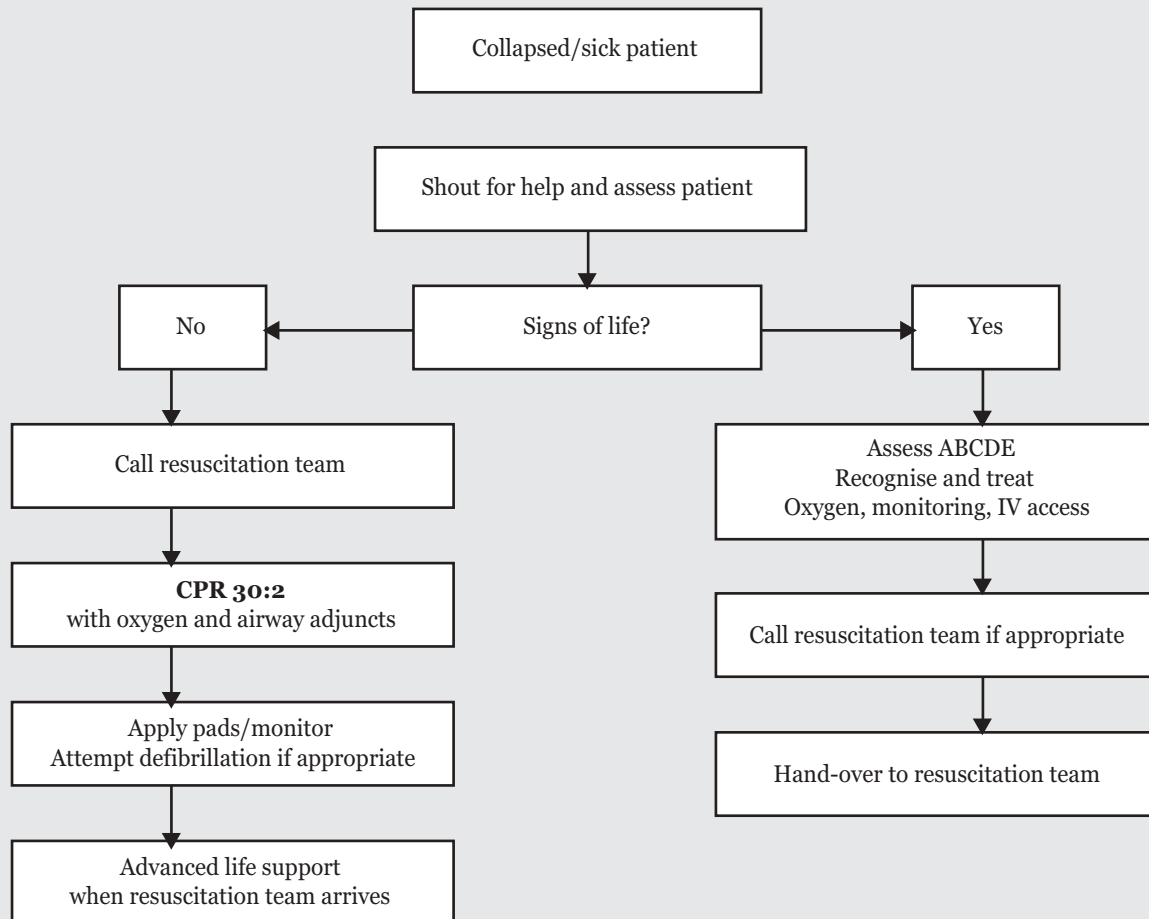
1. Treat patients who are critically ill or at risk of clinical deterioration in appropriate areas, matching the level of care to sickness severity.
2. Critically ill patients need regular observations to match the frequency and type of observations to the severity of illness or the likelihood of clinical deterioration and cardiopulmonary arrest. Often only simple vital sign observations (pulse, blood pressure, respiratory rate) are needed.

3. Use an Early Warning Scores system linked to an appropriate clinical response to identify patients who are critically ill or at risk of clinical deterioration and cardiopulmonary arrest.
4. Train all clinical staff in the recognition, monitoring and initial treatment of the critically ill patient.
5. Identify:
 - Patients for whom cardiopulmonary arrest is an anticipated terminal event and in whom CPR is inappropriate.
 - Patients who do not wish to be treated with CPR.

Hospitals should have a do not attempt resuscitation (DNAR) policy based on existing national guidance.

The immediate actions for a 'collapsed' patient in a hospital and the initial management of in-hospital cardiac arrest are shown in the algorithm depicted in Figure 4. This is a *new algorithm* included in the resuscitation guidelines as a result of scientific data that shows that approximately 80% of cardiac arrests in hospital are preceded by a slow and progressive physiological deterioration and that early and effective treatment of seriously ill patients might prevent some cardiac arrests, deaths and unanticipated ITU admissions.

Figure 4: Algorithm for the management of in-hospital cardiac arrest



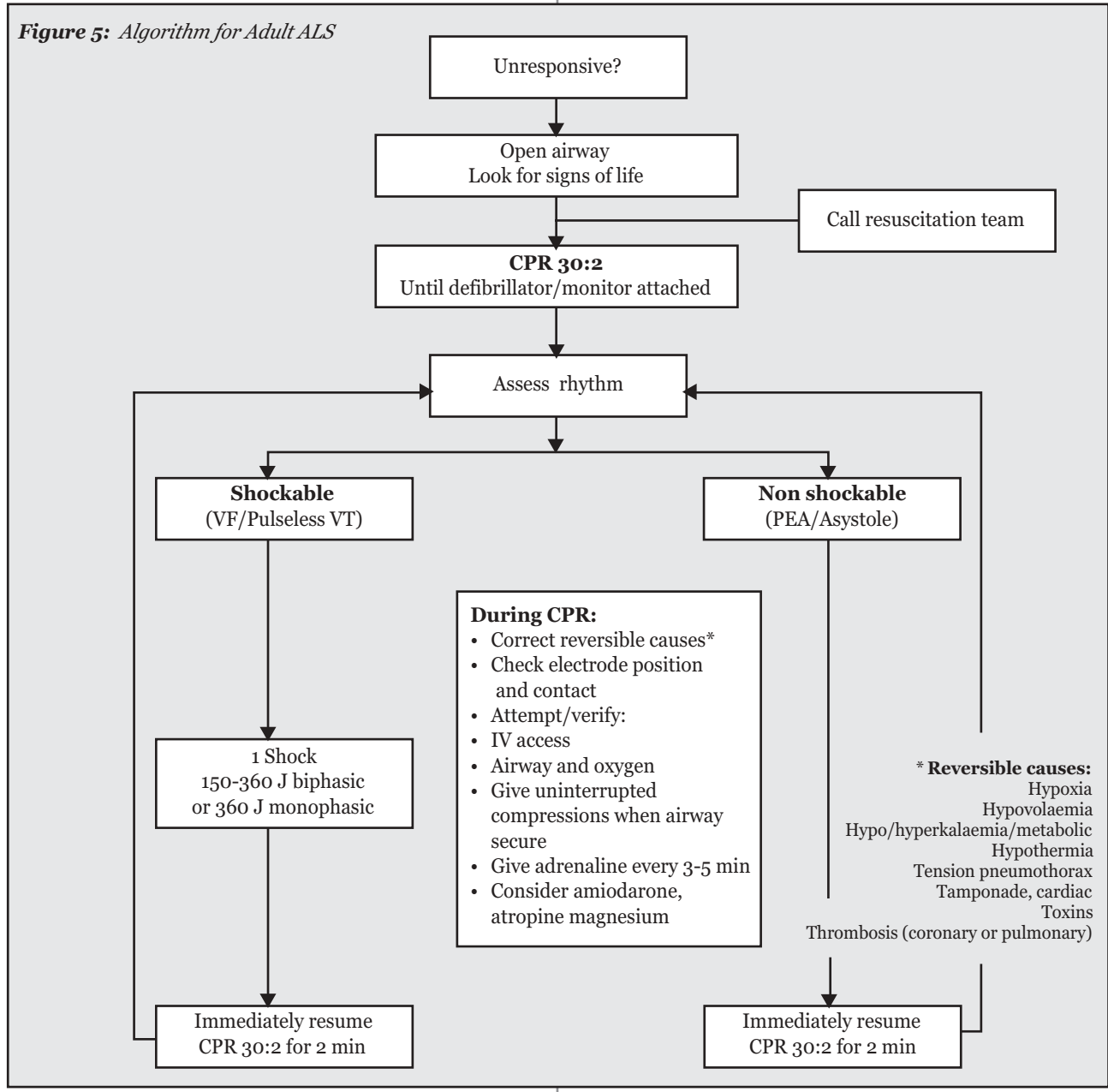
The new adult ALS algorithm (Figure 5) emphasizes again the importance of uninterrupted chest compressions by including more of these sequences between *solitary shocks for the shockable rhythms*. Defibrillatory shocks start and continue at 360J (monophasic defibrillators) energy levels and are delivered *every 2 minutes of CPR*, as necessary.

Defibrillation: One-shock versus three-shock sequence. With a three-shock protocol recommended in the 2000 guidelines, interruptions in CPR due to rhythm analysis were significant. Thus, immediately after giving a single shock, and without re-assessing the rhythm or feeling for a pulse, CPR (30 compressions: 2 ventilations) for 2 min is resumed before delivering another shock (if indicated). Even if the defibrillation attempt is successful in restoring a perfusing rhythm, it is very rare for a pulse to be palpable immediately after defibrillation and the delay in trying to palpate a pulse will further compromise the myocardium if a perfusing rhythm has not been

restored. If a perfusing rhythm has been restored, giving chest compressions does not increase the chance of VF recurring. In the presence of post-shock asystole, chest compressions may induce VF which has a better chance for reversal. This single shock strategy is applicable to both monophasic and biphasic defibrillators.

The precordial thump may be given when cardiac arrest is confirmed rapidly after a witnessed, sudden collapse and a defibrillator is not immediately to hand. These circumstances are most likely to occur when the patient is monitored. A precordial thump should be undertaken immediately after confirmation of cardiac arrest and only by healthcare professionals trained in the technique.

Airway and ventilation: Tracheal intubation provides the most reliable airway but should be attempted only if the healthcare provider is properly trained and has adequate ongoing experience with the technique. Personnel skilled in



advanced airway management should attempt laryngoscopy without stopping chest compressions – a brief pause in chest compressions may be required as the tube is passed through the vocal cords. Alternatively, to avoid any interruptions in chest compressions, the intubation attempt may be deferred until return of spontaneous circulation. No intubation attempt should take longer than 30 s: if intubation has not been achieved after this time, re-commence bag-mask ventilation. The lungs are ventilated at 10 breaths per min. In the absence of personnel skilled in tracheal intubation, acceptable alternatives are the Combitube, laryngeal mask airway (LMA), ProSeal LMA or laryngeal tube.

Drugs: The preferred route is peripheral venous cannulation since it is quick, easy to perform and safe. If intravenous access is difficult or impossible, consider the intraosseous route. Although normally considered as an alternative route for vascular access in children, it can also be effective in adults. Intraosseous injection of drugs achieves adequate plasma concentrations in a time comparable to injection through a central venous catheter. The intraosseous route also enables withdrawal of marrow for venous blood gas analysis and

measurement of electrolytes and haemoglobin concentration. If intravenous and intraosseous access cannot be established, some drugs can be given by the tracheal route. However, unpredictable plasma concentrations are achieved when drugs are given via a tracheal tube and the optimal tracheal dose of most drugs is unknown.

A recent meta-analysis of five randomized trials showed no statistically significant difference between *vasopressin* and *adrenaline* for return of spontaneous circulation (ROSC), death within 24 h or death before hospital discharge. Despite the absence of placebo-controlled trials, adrenaline has been the standard vasopressor in cardiac arrest. There is insufficient evidence to support or refute the use of vasopressin as an alternative to, or in combination with, adrenaline in any cardiac arrest rhythm. Thus *adrenaline remains as the primary vasopressor* for the treatment of cardiac arrest of all rhythms.

There is no evidence that giving any *anti-arrhythmic drug* routinely during human cardiac arrest increases survival to hospital discharge. In comparison with placebo and lidocaine, the use of amiodarone in shock refractory VF improves the short-term outcome of survival to hospital admission. On the

Figure 6: Algorithm for the management of bradycardias

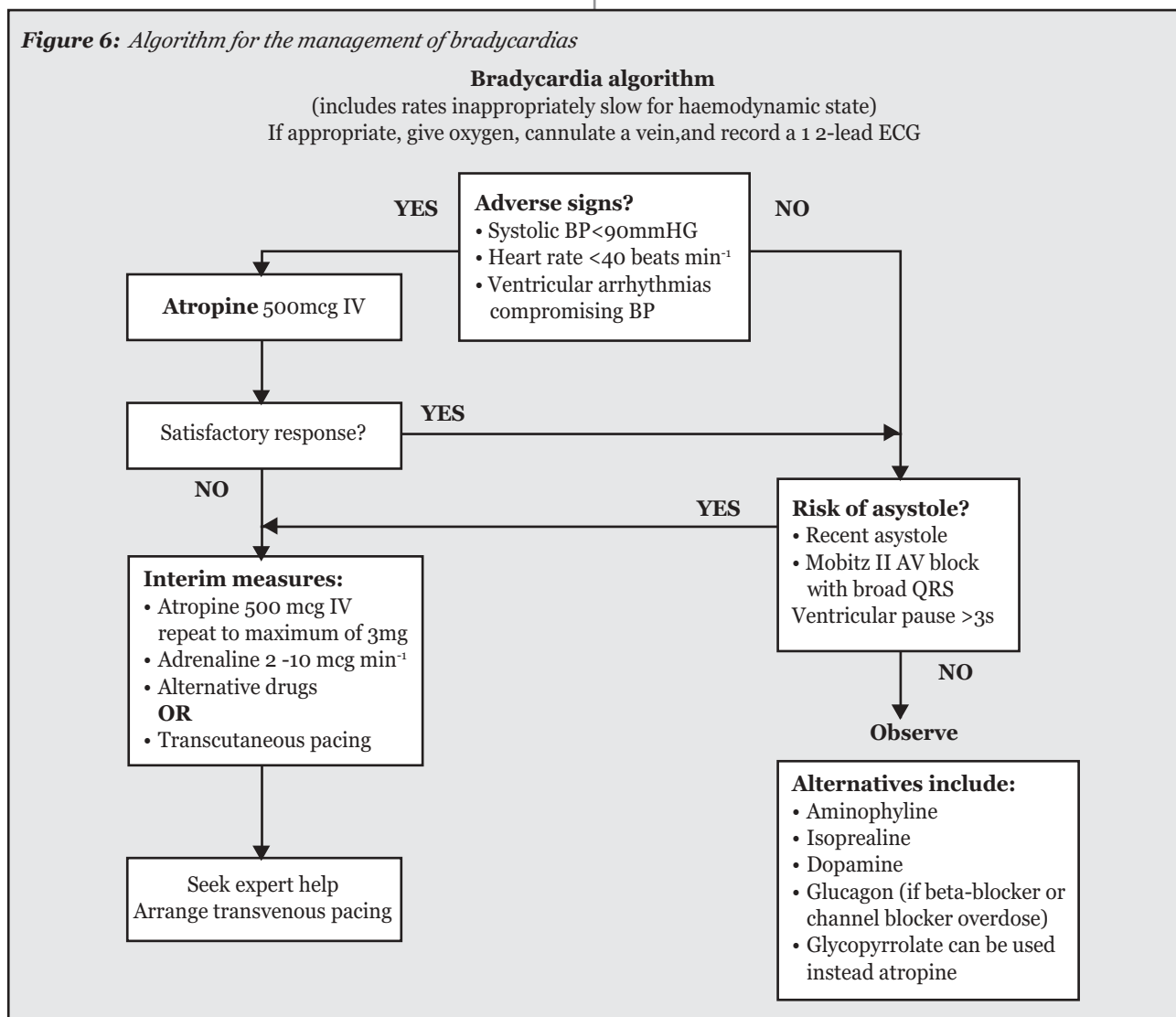


Figure 7: Algorithm for the management of tachycardias (with pulse)

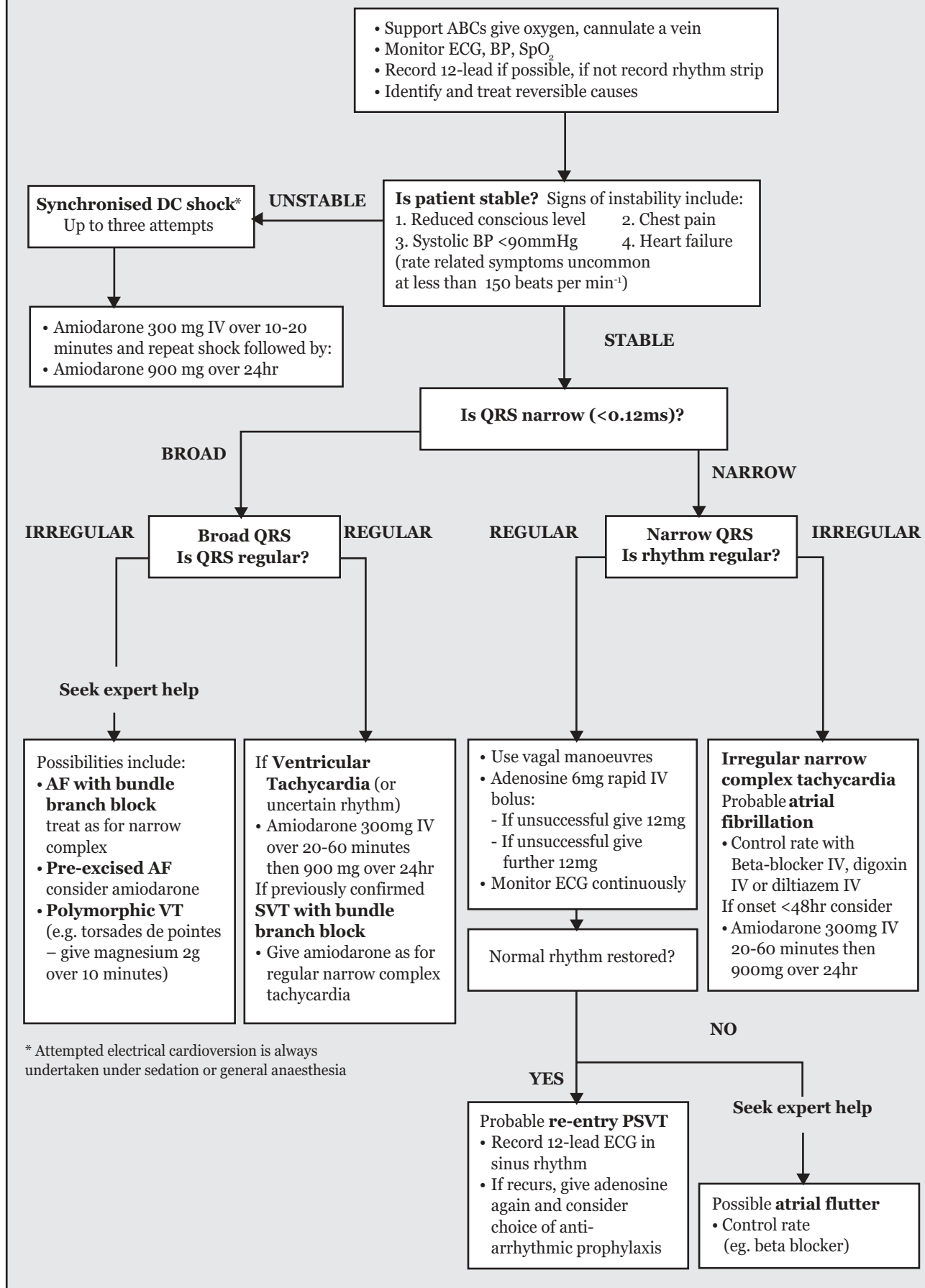
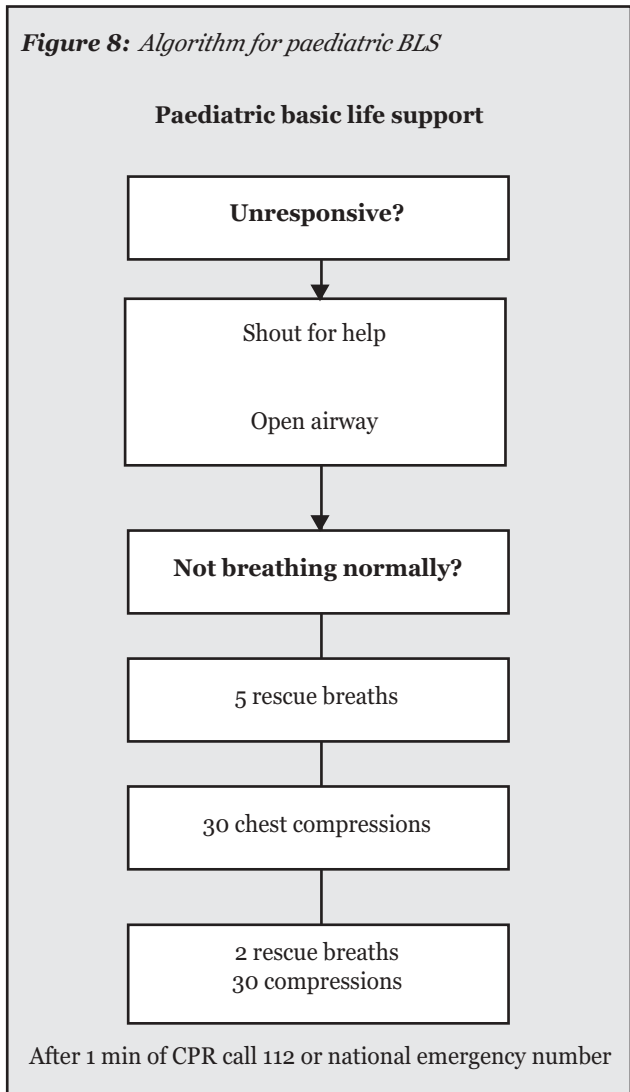


Figure 8: Algorithm for paediatric BLS



basis of expert consensus, if VF/VT persists after three shocks, amiodarone 300 mg is given by bolus injection. A further dose of 150 mg may be given for recurrent or refractory VF/VT, followed by an infusion of 900 mg over 24 h. Lidocaine 1mg/kg may be used as an alternative if amiodarone is not available, but it is not given if amiodarone has been administered already.

Magnesium may be used in refractory VF if there is any suspicion of hypomagnesaemia (e.g. patients on potassium-losing diuretics). Sodium bicarbonate is to be used if cardiac arrest is associated with hyperkalaemia or tricyclic antidepressant overdose. Although there is still no evidence that Atropine increases the chances for survival a dose of 3mg (the dose that will provide maximal vagal blockade) is given if there is asystole or PEA of less than 60/min. Calcium is indicated during resuscitation from PEA thought to be caused by hyperkalaemia, hypocalcaemia or overdose of calcium channel-blocking drugs.

Peri-arrest arrhythmias

Cardiac arrhythmias are well recognized complications of myocardial infarction. They may precede VF or follow successful defibrillation. The treatment algorithms described in this section of the guidelines have been designed to enable the non-specialist advanced life support (ALS) provider to treat the patient effectively and safely in an emergency. The Bradycardia algorithm (Figure 6) and the Tachycardia algorithm (Figure 7) are examples of such guidelines which are presented in a concise, simple form.

Figure 9: Algorithm for paediatric FBAO management

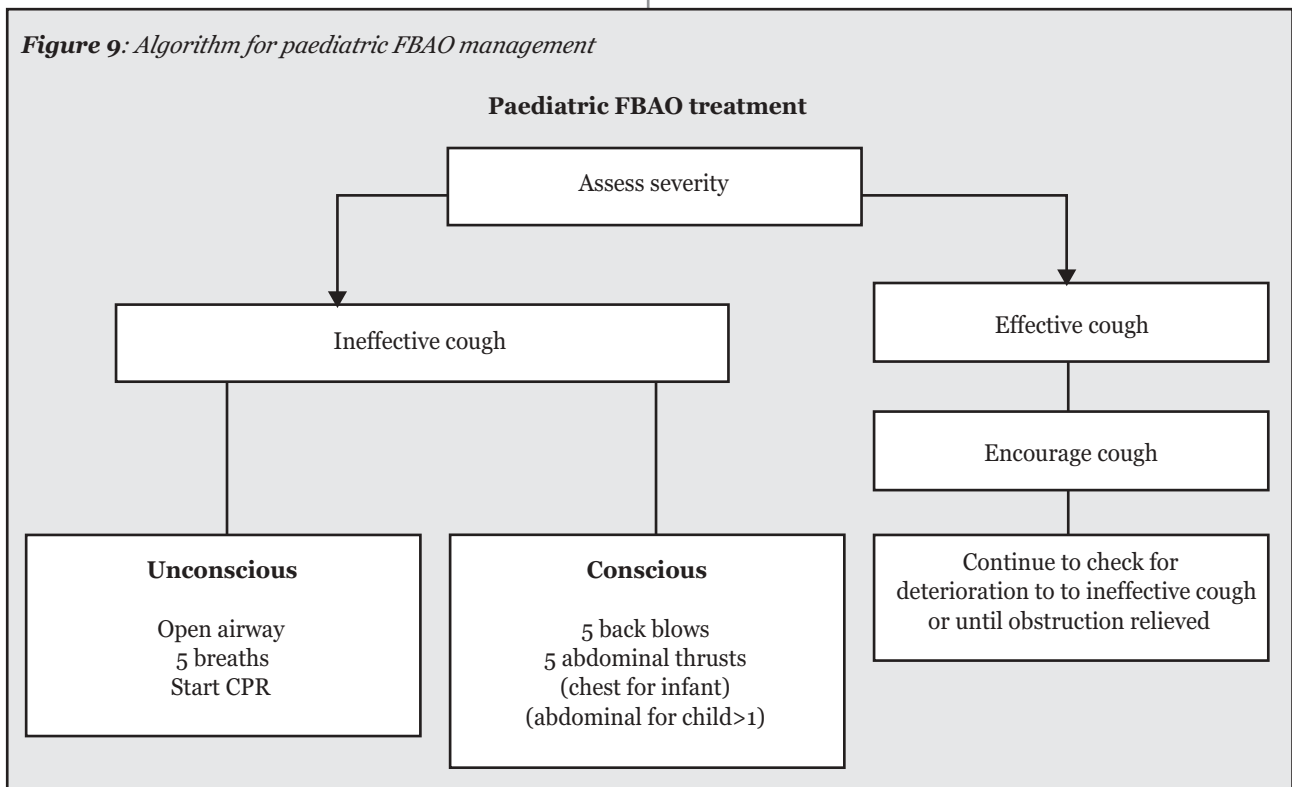
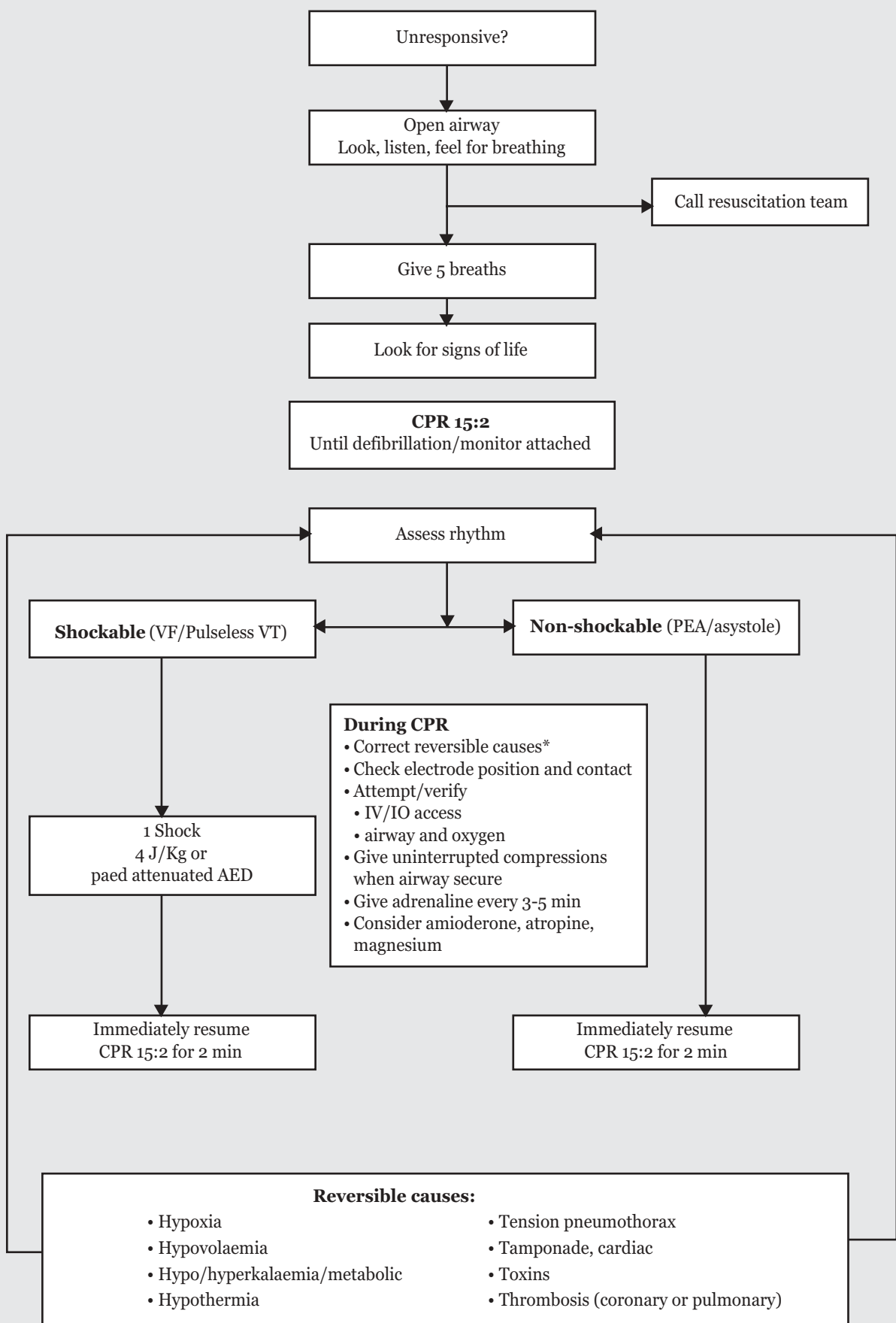


Figure 10: Algorithm for paediatric ALS management



Paediatric Basic Life Support

The current revision has a strong focus on simplification, based on the knowledge that many children receive no resuscitation at all because rescuers fear doing harm. The ILCOR treatment recommendation was that the compression:ventilation ratio should be based on whether one or more rescuers were present. ILCOR recommends that lay rescuers, who usually learn only single rescuer techniques, should be taught to use a ratio of *30 compressions to 2 ventilations*, which is the same as the adult guidelines and enables anyone trained in BLS techniques to resuscitate children with minimal additional information. Two or more rescuers with a duty to respond should learn a different ratio (15:2) as this has been validated by animal and manikin studies.

The new Paediatric BLS algorithm (Figure 8) emphasizes more chest compressions like in the adult with the difference that the initial action is 5 rescue breaths since it is known that the primary cause of arrest in children is a respiratory one. The Paediatric FBAO algorithm is shown in Figure 9.

Paediatric Advanced Life Support

The main differences here again are CPR ratio of compressions to ventilations which is increased to 15:2 and the repeat loop sequence every 2 minutes. For shockable rhythms defibrillation is followed by CPR after one shock (Figure 10). Detailed information about drugs, peri-arrest arrhythmias, post – resuscitation care and newborn life support is also included in this section of the new guidelines.

Post-resuscitation care

For patients in whom a spontaneous circulation is restored more in-depth guidelines are given for post-resuscitation care. Return of spontaneous circulation (ROSC) is just the first step toward the goal of complete recovery from cardiac arrest. To return the patient to a state of normal cerebral function with no neurological deficit, a stable cardiac rhythm, and normal haemodynamic function, requires further resuscitation tailored to each patient's individual needs. The 2005 guidelines give detailed suggestions how to best achieve good post – resuscitation care and prognostication of the neurological outcomes.

Cardiac arrest in special circumstances

The new guidelines give detailed information about the management of acute coronary syndromes, electrolyte imbalances, poisoning, hypo- and hyperthermia, asthma, anaphylaxis, trauma, pregnancy, electrocution and cardiac surgery. These are *new sections* and include a number of very concise and to the point management algorithms.

Ethics

The chapter on ethics discusses advance directives, DNAR orders, stopping resuscitation, the presence of relatives during resuscitation, bereavement counselling and research. Information on these issues is presented in a very clear way.

Conclusion

The ERC Executive Committee considers these new recommendations to be the most effective and easily learned interventions that can be supported by current knowledge, research and experience. The MRC recognizes these new guidelines and it is one of the main aims of the council to start their dissemination and implementation in Malta as well. The full guidelines will be available for browsing and downloading on the ERC website (www.erc.edu) from the 28th November 2005 and books will be available for purchase from the same site. The MRC will have this information on its website (www.resus.org.mt) and is preparing for a Resuscitation Symposium on the 12th February 2006. During this Symposium all the revised guidelines and the science behind them will be discussed and one guest speaker will be an important ERC executive member and co-author of the 2005 edition. Details of this event will soon be published and all doctors and paramedics interested in Resuscitation are invited to attend.

References

1. International Liaison Committee on Resuscitation. 2005 Cardiopulmonary Resuscitation and Emergency Cardiovascular Science with Treatment Recommendations (CoSTR).
2. European Resuscitation Council. European Resuscitation Council Guidelines for Resuscitation 2005.