



**EUROPEAN  
RESUSCITATION  
COUNCIL**



# **Summary of the main changes in the Resuscitation Guidelines**

**ERC GUIDELINES 2010**





The Network of National Resuscitation Councils

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# Summary of main changes since 2005 Guidelines

## Basic life support

Changes in basic life support (BLS) since the 2005 guidelines include:

- ◆ Dispatchers should be trained to interrogate callers with strict protocols to elicit information. This information should focus on the recognition of unresponsiveness and the quality of breathing. In combination with unresponsiveness, absence of breathing or any abnormality of breathing should start a dispatch protocol for suspected cardiac arrest. The importance of gasping as sign of cardiac arrest is emphasised.
- ◆ All rescuers, trained or not, should provide chest compressions to victims of cardiac arrest. A strong emphasis on delivering high quality chest compressions remains essential. The aim should be to push to a depth of at least 5 cm at a rate of at least 100 compressions  $\text{min}^{-1}$ , to allow full chest recoil, and to minimise interruptions in chest compressions. Trained rescuers should also provide ventilations with a compression–ventilation (CV) ratio of 30:2. Telephone-guided chest compression-only CPR is encouraged for untrained rescuers.
- ◆ The use of prompt/feedback devices during CPR will enable immediate feedback to rescuers and is encouraged. The data stored in rescue equipment can be used to monitor and

improve the quality of CPR performance and provide feedback to professional rescuers during debriefing sessions.

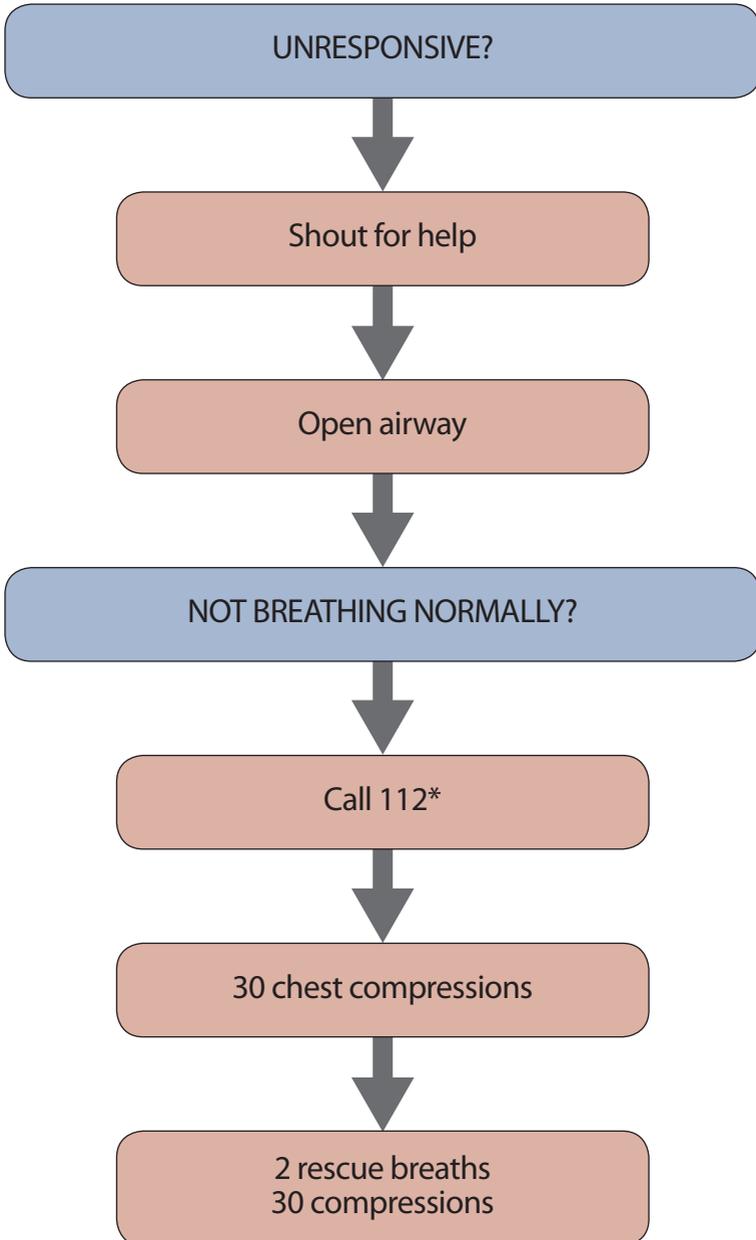
## Electrical therapies: automated external defibrillators, defibrillation, cardioversion and pacing

The most important changes in the 2010 ERC Guidelines for electrical therapies include:

- ◆ The importance of early, uninterrupted chest compressions is emphasised throughout these guidelines.
- ◆ Much greater emphasis on minimising the duration of the pre-shock and post-shock pauses; the continuation of compressions during charging of the defibrillator is recommended.
- ◆ Immediate resumption of chest compressions following defibrillation is also emphasised; in combination with continuation of compressions during defibrillator charging, the delivery of defibrillation should be achievable with an interruption in chest compressions of no more than 5 seconds.
- ◆ Safety of the rescuer remains paramount, but there is recognition in

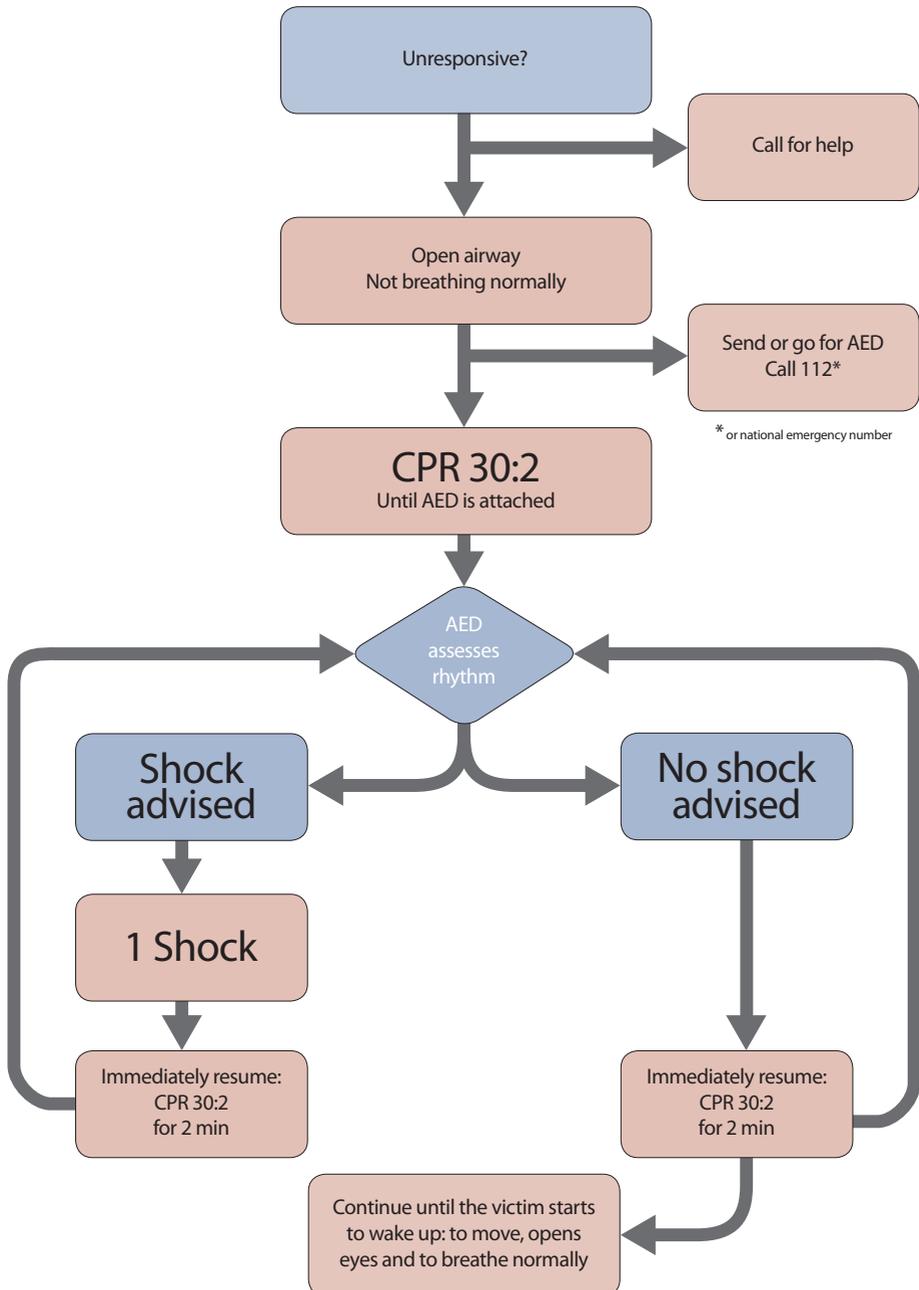


# Adult Basic Life Support

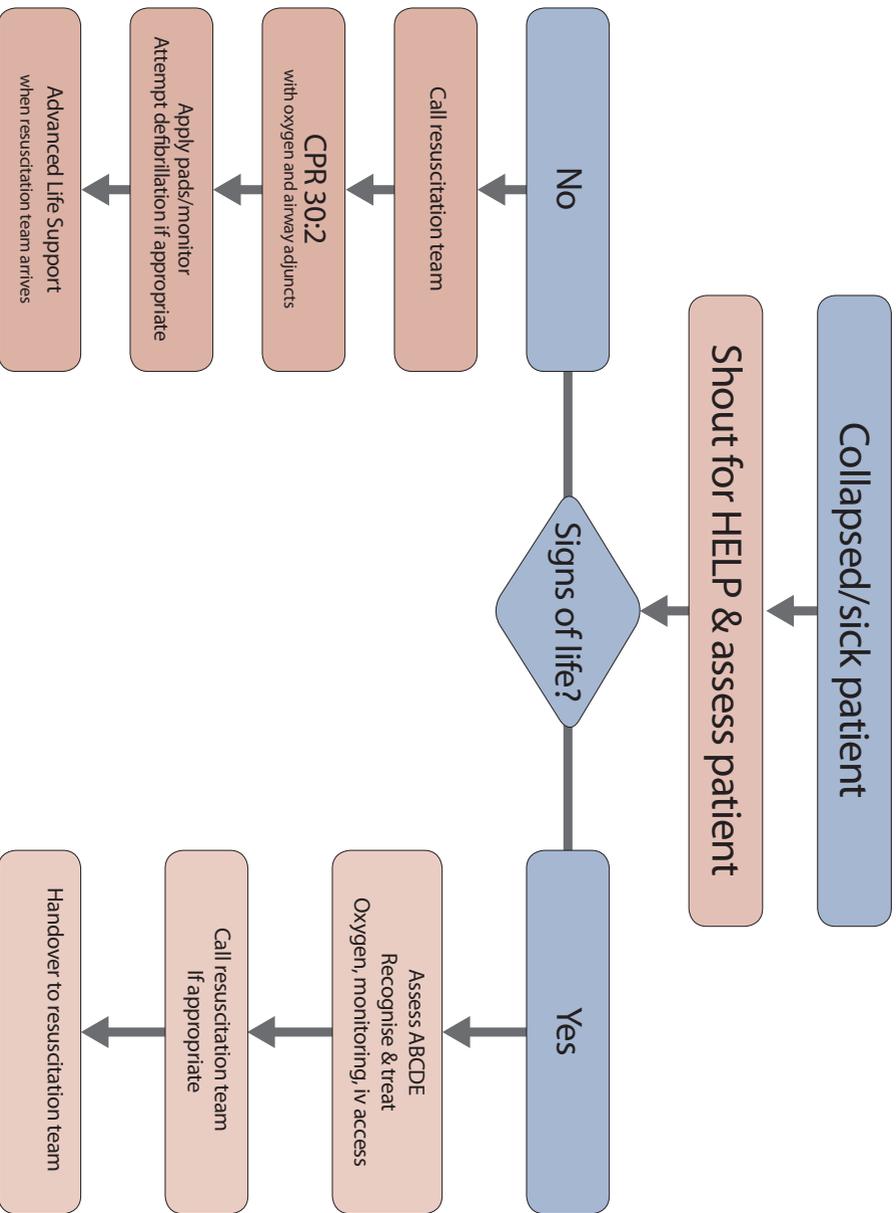


\*or national emergency number

# Automated External Defibrillation



# In Hospital Resuscitation



these guidelines that the risk of harm to a rescuer from a defibrillator is very small, particularly if the rescuer is wearing gloves. The focus is now on a rapid safety check to minimise the pre-shock pause.

◆ When treating out-of-hospital cardiac arrest, emergency medical services (EMS) personnel should provide good-quality CPR while a defibrillator is retrieved, applied and charged, but routine delivery of a pre-specified period of CPR (e.g., two or three minutes) before rhythm analysis and a shock is delivered is no longer recommended. For some EMS that have already fully implemented a pre-specified period of chest compressions before defibrillation, given the lack of convincing data either supporting or refuting this strategy, it is reasonable for them to continue this practice.

◆ The use of up to three-stacked shocks may be considered if VF/VT occurs during cardiac catheterisation or in the early post-operative period following cardiac surgery. This three-shock strategy may also be considered for an initial, witnessed VF/VT cardiac arrest when the patient is already connected to a manual defibrillator.

◆ Further development of AED programmes is encouraged – there is a need for further deployment of AEDs in both public and residential areas.

## Adult advanced life support

The most important changes in the 2010 ERC Advanced Life Support (ALS) Guidelines include:

◆ Increased emphasis on the importance of minimally interrupted high-quality chest compressions throughout any ALS intervention: chest compressions are paused briefly only to enable specific interventions.

◆ Increased emphasis on the use of ‘track and trigger systems’ to detect the deteriorating patient and enable treatment to prevent in-hospital cardiac arrest.

◆ Increased awareness of the warning signs associated with the potential risk of sudden cardiac death out of hospital.

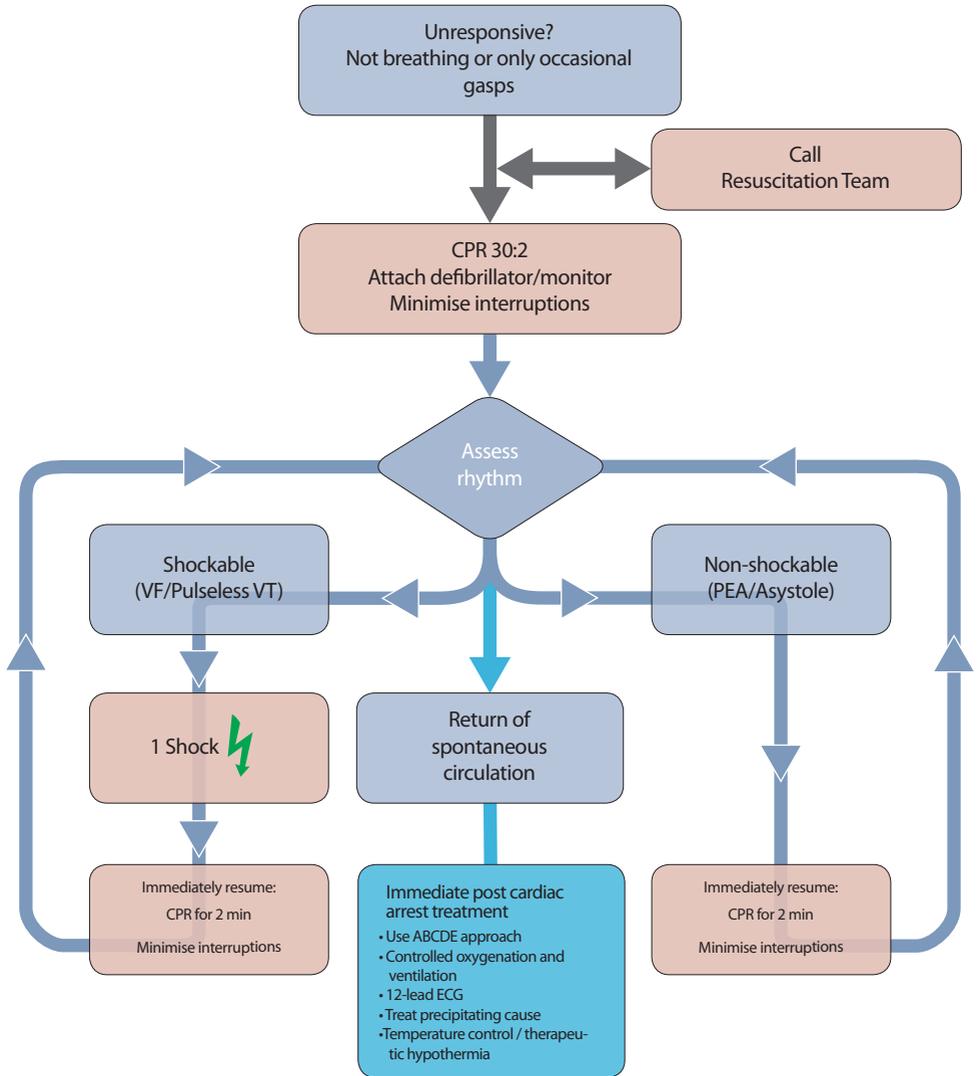
◆ Removal of the recommendation for a pre-specified period of cardiopulmonary resuscitation (CPR) before out-of-hospital defibrillation following cardiac arrest unwitnessed by the EMS.

◆ Continuation of chest compressions while a defibrillator is charged - this will minimise the pre-shock pause.

◆ The role of the precordial thump is de-emphasised.



# Advanced Life Support



## During CPR

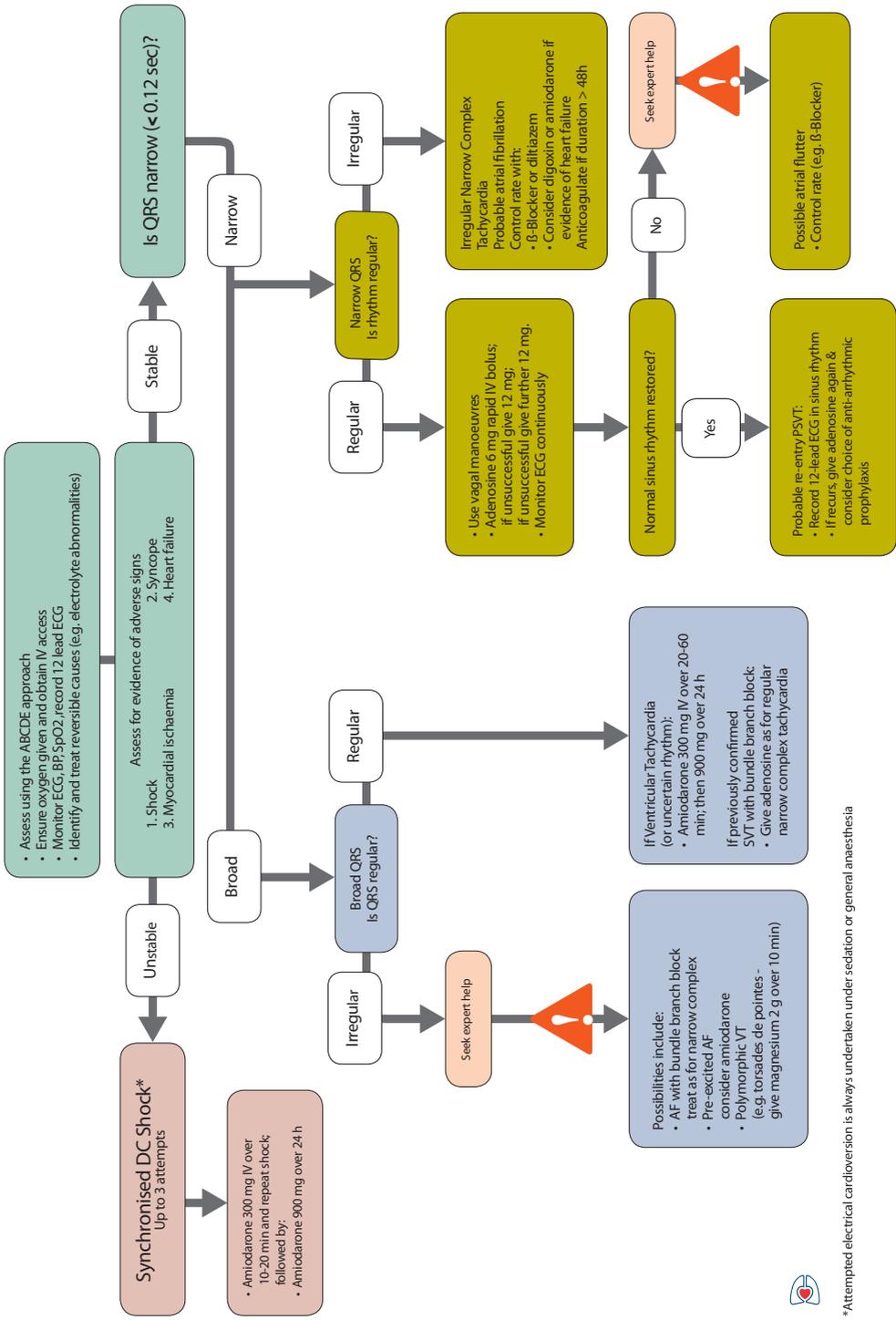
- Ensure high-quality CPR: rate, depth, recoil
- Plan actions before interrupting CPR
- Give oxygen
- Consider advanced airway and capnography
- Continuous chest compressions when advanced airway in place
- Vascular access (intravenous, intraosseous)
- Give adrenaline every 3-5 min
- Correct reversible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

## Reversible causes

- Hypoxia
- Hypovolaemia
- Hypo-/hyperkalaemia/metabolic
- Hypothermia
- Thrombosis
- Tamponade - cardiac
- Toxins
- Tension pneumothorax



# Tachycardia (with pulse)



\*Attempted electrical cardioversion is always undertaken under sedation or general anaesthesia



# Bradycardia

• Assess using the ABCDE approach  
• Ensure oxygen given and obtain IV access  
• Monitor ECG, BP, SpO<sub>2</sub>, record 12 lead ECG  
• Identify and treat reversible causes (e.g. electrolyte abnormalities)

Assess for evidence of adverse signs:  
1 Shock  
2 Syncope  
3 Myocardial ischaemia  
4 Heart failure

Yes

No

Atropine  
500 mcg IV

Satisfactory  
Response?

Yes

No

Risk of asystole?  
• Recent asystole  
• Möbitz II AV block  
• Complete heart block with broad QRS  
• Ventricular pause > 3s

Yes

No

Interim measures:  
• Atropine 500 mcg IV repeat to maximum of 3 mg  
• Isoprenaline 5 mcg min<sup>-1</sup>  
• Adrenaline 2-10 mcg min<sup>-1</sup>  
• Alternative drugs\*  
OR  
• Transcutaneous pacing



Seek expert help  
Arrange transvenous pacing

Observe

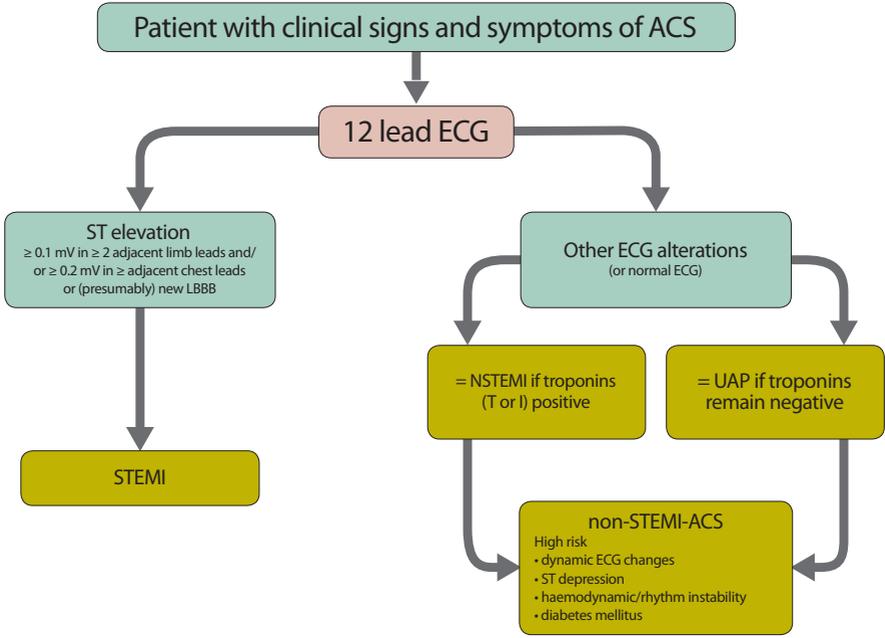
\* Alternatives include:  
• Aminophylline  
• Dopamine  
• Glucagon (if beta-blocker or calcium channel blocker overdose)  
• Glycopyrrolate can be used instead of atropine



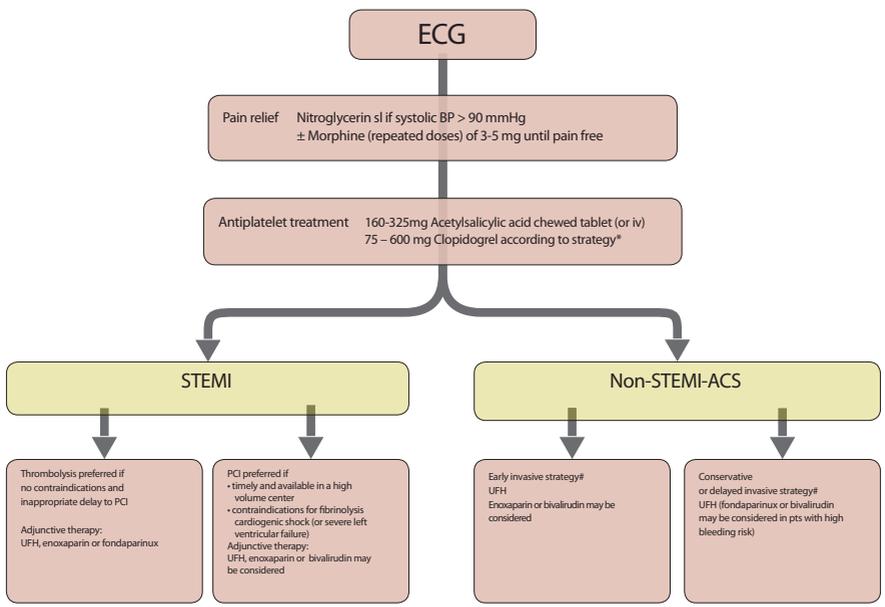
- ◆ The use of up to three quick successive (stacked) shocks for ventricular fibrillation/pulseless ventricular tachycardia (VF/VT) occurring in the cardiac catheterisation laboratory or in the immediate post-operative period following cardiac surgery.
- ◆ Delivery of drugs via a tracheal tube is no longer recommended – if intravenous access cannot be achieved, drugs should be given by the intraosseous (IO) route.
- ◆ When treating VF/VT cardiac arrest, adrenaline 1 mg is given after the third shock once chest compressions have restarted and then every 3-5 minutes (during alternate cycles of CPR). Amiodarone 300 mg is also given after the third shock.
- ◆ Atropine is no longer recommended for routine use in asystole or pulseless electrical activity (PEA).
- ◆ Reduced emphasis on early tracheal intubation unless achieved by highly skilled individuals with minimal interruption to chest compressions.
- ◆ Increased emphasis on the use of capnography to confirm and continually monitor tracheal tube placement, quality of CPR and to provide an early indication of return of spontaneous circulation (ROSC).
- ◆ The potential role of ultrasound imaging during ALS is recognised.
- ◆ Recognition of the potential harm caused by hyperoxaemia after ROSC is achieved: once ROSC has been established and the oxygen saturation of arterial blood ( $\text{SaO}_2$ ) can be monitored reliably (by pulse oximetry and/or arterial blood gas analysis), inspired oxygen is titrated to achieve a  $\text{SaO}_2$  of 94 – 98%.
- ◆ Much greater detail and emphasis on the treatment of the post-cardiac arrest syndrome.
- ◆ Recognition that implementation of a comprehensive, structured post resuscitation treatment protocol may improve survival in cardiac arrest victims after ROSC.
- ◆ Increased emphasis on the use of primary percutaneous coronary intervention in appropriate (including comatose) patients with sustained ROSC after cardiac arrest.
- ◆ Revision of the recommendation for glucose control: in adults with sustained ROSC after cardiac arrest, blood glucose values  $>10 \text{ mmol l}^{-1}$  ( $>180 \text{ mg dl}^{-1}$ ) should be treated but hypoglycaemia must be avoided.



# ACS



# ECG



- ◆ Use of therapeutic hypothermia to include comatose survivors of cardiac arrest associated initially with non-shockable rhythms as well shockable rhythms. The lower level of evidence for use after cardiac arrest from non-shockable rhythms is acknowledged.

- ◆ Recognition that many of the accepted predictors of poor outcome in comatose survivors of cardiac arrest are unreliable, especially if the patient has been treated with therapeutic hypothermia.

## Initial management of acute coronary syndromes

Changes in the management of acute coronary syndrome since the 2005 guidelines include:

- ◆ The term non-ST-elevation myocardial infarction-acute coronary syndrome (non-STEMI-ACS) has been introduced for both NSTEMI and unstable angina pectoris because the differential diagnosis is dependent on biomarkers that may be detectable only after several hours, whereas decisions on treatment are dependent on the clinical signs at presentation.

- ◆ History, clinical examinations, biomarkers, ECG criteria and risk scores are unreliable for the identification of patients who may be safely discharged early.

- ◆ The role of chest pain observation units (CPUs) is to identify, by using repeated clinical examinations, ECG and biomarker testing, those patients who require admission for invasive procedures. This may include provocative testing and, in selected patients, imaging procedures such as cardiac computed tomography, magnetic resonance imaging etc.

- ◆ Non-steroidal anti-inflammatory drugs (NSAIDs) should be avoided.

- ◆ Nitrates should not be used for diagnostic purposes.

- ◆ Supplementary oxygen is to be given only to those patients with hypoxaemia, breathlessness or pulmonary congestion. Hyperoxaemia may be harmful in uncomplicated infarction.

- ◆ Guidelines for treatment with acetyl salicylic acid (ASA) have been made more liberal: ASA may now be given by bystanders with or without EMS dispatcher assistance.

- ◆ Revised guidance for new anti-platelet and anti-thrombin treatment for patients with STEMI and non-STEMI-ACS based on therapeutic strategy.



◆ Gp IIb/IIIa inhibitors before angiography/percutaneous coronary intervention (PCI) are discouraged.

◆ The reperfusion strategy in ST-elevation myocardial infarction has been updated:

- Primary PCI (PPCI) is the preferred reperfusion strategy provided it is performed in a timely manner by an experienced team.

- A nearby hospital may be bypassed by emergency medical services (EMS) provided PPCI can be achieved without too much delay.

- The acceptable delay between start of fibrinolysis and first balloon inflation varies widely between about 45 and 180 minutes depending on infarct localisation, age of the patient, and duration of symptoms.

- 'Rescue PCI' should be undertaken if fibrinolysis fails.

- The strategy of routine PCI immediately after fibrinolysis ('facilitated PCI') is discouraged.

- Patients with successful fibrinolysis but not in a PCI-capable hospital should be transferred for angiography and eventual PCI, performed optimally 6 – 24 hours after fibrinolysis (the 'pharmaco-invasive' approach).

- Angiography and, if necessary, PCI may be reasonable in patients with return of spontaneous circulation (ROSC) after cardiac arrest and may be part of a standardised post-cardiac arrest protocol.

- To achieve these goals, the creation of networks including EMS, non PCI capable hospitals and PCI hospitals is useful.

◆ Recommendations for the use of beta-blockers are more restricted: there is no evidence for routine intravenous beta-blockers except in specific circumstances such as for the treatment of tachyarrhythmias. Otherwise, beta-blockers should be started in low doses only after the patient is stabilised.

◆ Guidelines on the use of prophylactic anti-arrhythmics, angiotensin converting enzyme (ACE) inhibitors/angiotensin receptor blockers (ARBs) and statins are unchanged.

## Paediatric life support

Major changes in these new guidelines for paediatric life support include:

◆ Recognition of cardiac arrest - Healthcare providers cannot reliably determine the presence or absence of a pulse in less than 10 seconds in



infants or children. Healthcare providers should look for signs of life and if they are confident in the technique, they may add pulse palpation for diagnosing cardiac arrest and decide whether they should begin chest compressions or not. The decision to begin CPR must be taken in less than 10 seconds. According to the child's age, carotid (children), brachial (infants) or femoral pulse (children and infants) checks may be used.

◆ The compression ventilation (CV) ratio used for children should be based on whether one, or more than one rescuer is present. 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 to resuscitate children with minimal additional information. Rescuers with a duty to respond should learn and use a 15:2 CV ratio; however, they can use the 30:2 ratio if they are alone, particularly if they are not achieving an adequate number of compressions. Ventilation remains a very important component of CPR in asphyxial arrests. Rescuers who are unable or unwilling to provide mouth-to-mouth ventilation should be encouraged to perform at least compression-only CPR.

◆ The emphasis is on achieving quality compressions of an adequate depth with minimal interruptions to

minimise no-flow time. Compress the chest to at least 1/3 of the anterior-posterior chest diameter in all children (i.e., approximately 4 cm in infants and approximately 5 cm in children). Subsequent complete release is emphasised. For both infants and children, the compression rate should be at least 100 but not greater than 120 min<sup>-1</sup>. The compression technique for infants includes two-finger compression for single rescuers and the two-thumb encircling technique for two or more rescuers. For older children, a one- or two-hand technique can be used, according to rescuer preference.

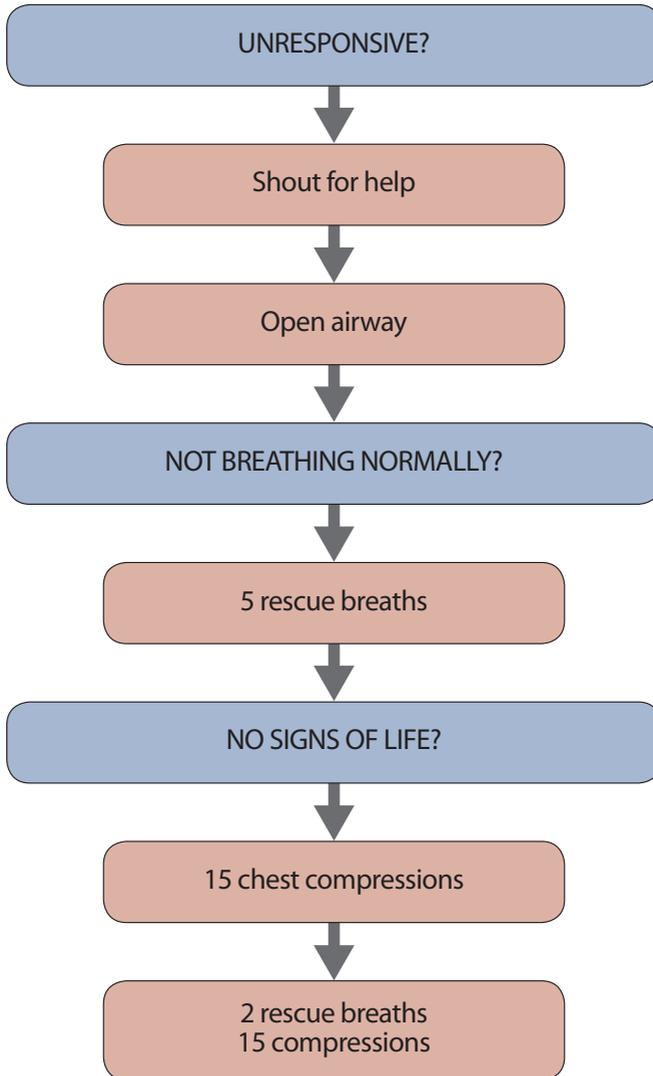
◆ Automated external defibrillators (AEDs) are safe and successful when used in children older than one year of age. Purpose-made paediatric pads or software attenuate the output of the machine to 50–75 J and these are recommended for children aged 1–8 years. If an attenuated shock or a manually adjustable machine is not available, an unmodified adult AED may be used in children older than 1 year. There are case reports of successful use of AEDs in children aged less than 1 year; in the rare case of a shockable rhythm occurring in a child less than 1 year, it is reasonable to use an AED (preferably with dose attenuator).

◆ To reduce the no flow time, when using a manual defibrillator, chest compressions are continued while applying and charging the paddles or



# Paediatric Basic Life Support

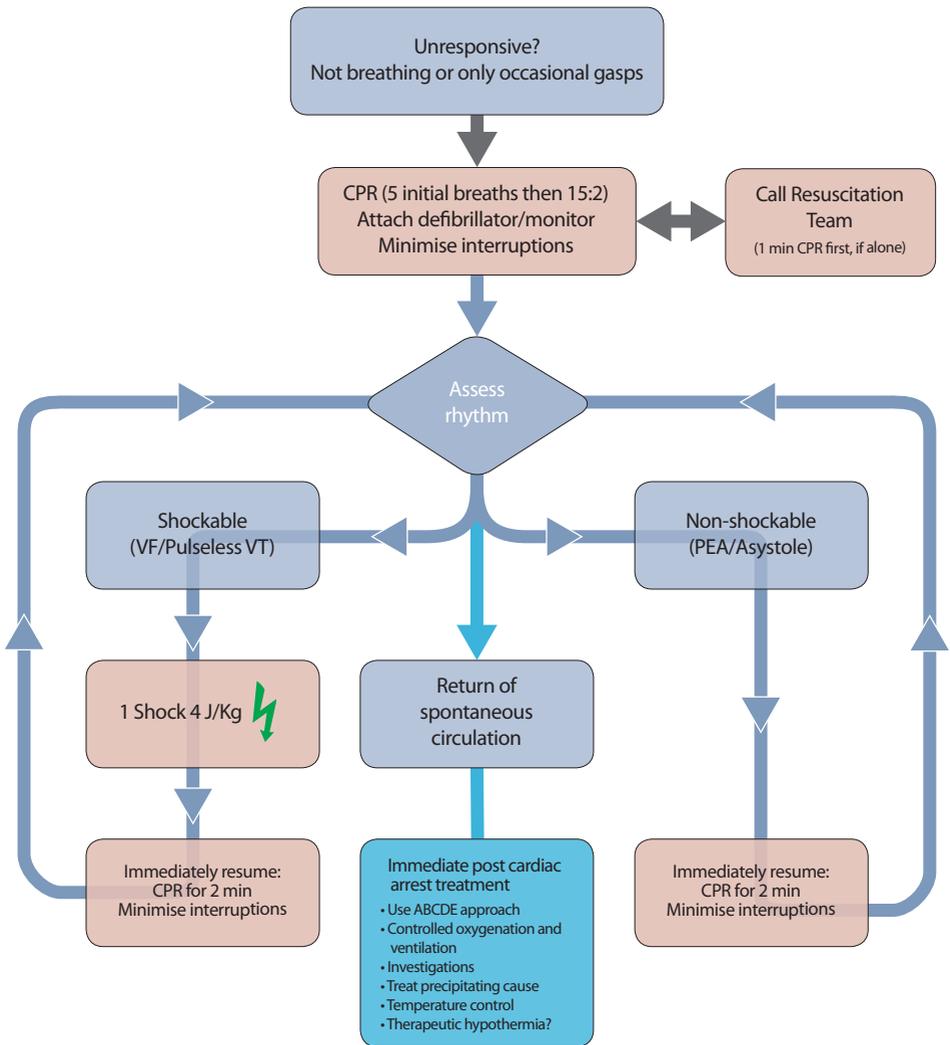
Health professionals with a duty to respond



Call cardiac arrest team or Paediatric ALS team



# Paediatric Advanced Life Support



## 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

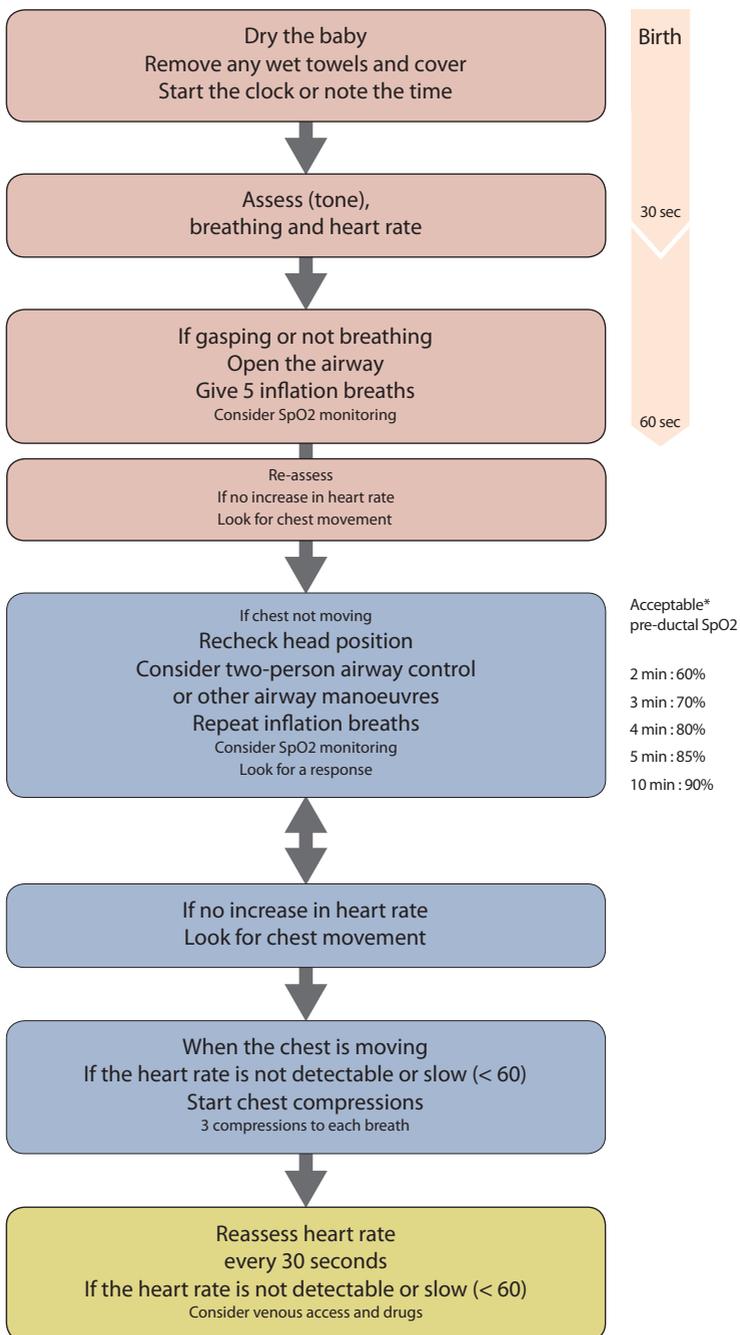
## Reversible causes

- Hypoxia
- Hypovolaemia
- Hypo-/hyperkalaemia/metabolic
- Hypothermia
- Tension pneumothorax
- Toxins
- Tamponade - cardiac
- Thromboembolism



# Newborn Life Support

AT ALL STAGES ASK: DO YOU NEED HELP?



self-adhesive pads (if the size of the child's chest allows this). Chest compressions are paused briefly once the defibrillator is charged to deliver the shock. For simplicity and consistency with adult BLS and ALS guidance, a single-shock strategy using a non-escalating dose of  $4 \text{ J kg}^{-1}$  (preferably biphasic, but monophasic is acceptable) is recommended for defibrillation in children.

- ◆ Cuffed tracheal tubes can be used safely in infants and young children. The size should be selected by applying a validated formula.

- ◆ The safety and value of using cricoid pressure during tracheal intubation is not clear. Therefore, the application of cricoid pressure should be modified or discontinued if it impedes ventilation or the speed or ease of intubation.

- ◆ Monitoring exhaled carbon dioxide ( $\text{CO}_2$ ), ideally by capnography, is helpful to confirm correct tracheal tube position and recommended during CPR to help assess and optimise its quality.

- ◆ Once spontaneous circulation is restored, inspired oxygen should be titrated to limit the risk of hyperoxaemia.

- ◆ Implementation of a rapid response system in a paediatric inpatient setting may reduce rates of cardiac and respiratory arrest and in-hospital mortality.

- ◆ New topics in the 2010 guidelines include channelopathies and several new special circumstances: trauma, single ventricle pre and post 1st stage repair, post Fontan circulation, and pulmonary hypertension.

## Resuscitation of babies at birth

The following are the main changes that have been made to the guidelines for resuscitation at birth in 2010:

- ◆ For uncompromised babies, a delay in cord clamping of at least one minute from the complete delivery of the infant, is now recommended. As yet there is insufficient evidence to recommend an appropriate time for clamping the cord in babies who are severely compromised at birth.

- ◆ For term infants, air should be used for resuscitation at birth. If, despite effective ventilation, oxygenation (ideally guided by oximetry) remains unacceptable, use of a higher concentration of oxygen should be considered.



- ◆ Preterm babies less than 32 weeks gestation may not reach the same transcutaneous oxygen saturations in air as those achieved by term babies. Therefore blended oxygen and air should be given judiciously and its use guided by pulse oximetry. If a blend of oxygen and air is not available use what is available.
- ◆ Preterm babies of less than 28 weeks gestation should be completely covered in a food-grade plastic wrap or bag up to their necks, without drying, immediately after birth. They should then be nursed under a radiant heater and stabilised. They should remain wrapped until their temperature has been checked after admission. For these infants delivery room temperatures should be at least 26°C.
- ◆ The recommended compression:ventilation ratio for CPR remains at 3:1 for newborn resuscitation.
- ◆ Attempts to aspirate meconium from the nose and mouth of the unborn baby, while the head is still on the perineum, are not recommended. If presented with a floppy, apnoeic baby born through meconium it is reasonable to rapidly inspect the oropharynx to remove potential obstructions. If appropriate expertise is available, tracheal intubation and suction may be useful. However, if attempted intubation is prolonged or unsuccessful, start mask ventilation, particularly if there is persistent bradycardia.
- ◆ If adrenaline is given then the intravenous route is recommended using a dose of 10-30 microgram  $\text{kg}^{-1}$ . If the tracheal route is used, it is likely that a dose of at least 50-100 microgram  $\text{kg}^{-1}$  will be needed to achieve a similar effect to 10 microgram  $\text{kg}^{-1}$  intravenously.
- ◆ Detection of exhaled carbon dioxide in addition to clinical assessment is recommended as the most reliable method to confirm placement of a tracheal tube in neonates with spontaneous circulation.
- ◆ Newly born infants born at term or near-term with evolving moderate to severe hypoxic – ischaemic encephalopathy should, where possible, be treated with therapeutic hypothermia. This does not affect immediate resuscitation but is important for post-resuscitation care.



## Principles of education in resuscitation

The key issues identified by the Education, Implementation and Teams (EIT) task force of the International Liaison Committee on Resuscitation (ILCOR) during the Guidelines 2010 evidence evaluation process are:

- ◆ Educational interventions should be evaluated to ensure that they reliably achieve the learning objectives. The aim is to ensure that learners acquire and retain the skills and knowledge that will enable them to act correctly in actual cardiac arrests and improve patient outcomes.
- ◆ Short video/computer self-instruction courses, with minimal or no instructor coaching, combined with hands-on practice can be considered as an effective alternative to instructor-led basic life support (CPR and AED) courses.
- ◆ Ideally all citizens should be trained in standard CPR that includes compressions and ventilations. There are circumstances however where training in compression-only CPR is appropriate (e.g., opportunistic training with very limited time). Those trained in compression-only CPR should be encouraged to learn standard CPR.
- ◆ Basic and advanced life support knowledge and skills deteriorate in as little as three to six months. The use of frequent assessments will identify those individuals who require refresher training to help maintain their knowledge and skills.
- ◆ CPR prompt or feedback devices improve CPR skill acquisition and retention and should be considered during CPR training for laypeople and healthcare professionals.
- ◆ An increased emphasis on non-technical skills (NTS) such as leadership, teamwork, task management and structured communication will help improve the performance of CPR and patient care.
- ◆ Team briefings to plan for resuscitation attempts, and debriefings based on performance during simulated or actual resuscitation attempts should be used to help improve resuscitation team and individual performance.
- ◆ Research about the impact of resuscitation training on actual patient outcomes is limited. Although manikin studies are useful, researchers should be encouraged to study and report the impact of educational interventions on actual patient outcomes.



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Edited by Jerry Nolan

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