

European Resuscitation Council Guidelines for Resuscitation 2010 Section 1. Executive summary

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Introduction

The publication of these European Resuscitation Council (ERC) Guidelines for cardiopulmonary resuscitation (CPR) updates those that were published in 2005 and maintains the established 5-yearly cycle of guideline changes.¹ Like the previous guidelines, these 2010 guidelines are based on the most recent International Consensus on CPR Science with Treatment Recommendations (CoSTR),² which incorporated the results of systematic reviews of a wide range of topics relating to CPR. Resuscitation science continues to advance, and clinical guidelines must be updated regularly to reflect these developments and advise healthcare providers on best practice. In between the 5-yearly guideline updates, interim scientific statements can inform the healthcare provider about new therapies that might influence outcome significantly.³

This executive summary provides the essential treatment algorithms for the resuscitation of children and adults and highlights the main guideline changes since 2005. Detailed guidance is provided in each of the remaining nine sections, which are published as individual papers within this issue of Resuscitation. The sections of the 2010 guidelines are:

1. Executive summary;
2. Adult basic life support and use of automated external defibrillators;⁴
3. Electrical therapies: automated external defibrillators, defibrillation, cardioversion and pacing;⁵
4. Adult advanced life support;⁶

5. Initial management of acute coronary syndromes;⁷
6. Paediatric life support;⁸
7. Resuscitation of babies at birth;⁹
8. Cardiac arrest in special circumstances: electrolyte abnormalities, poisoning, drowning, accidental hypothermia, hyperthermia, asthma, anaphylaxis, cardiac surgery, trauma, pregnancy, electrocution;¹⁰
9. Principles of education in resuscitation;¹¹
10. The ethics of resuscitation and end-of-life decisions.¹²

The guidelines that follow do not define the only way that resuscitation can be delivered; they merely represent a widely accepted view of how resuscitation should be undertaken both safely and effectively. The publication of new and revised treatment recommendations does not imply that current clinical care is either unsafe or ineffective.

Summary of main changes since 2005 Guidelines

Basic life support

Changes in basic life support (BLS) since the 2005 guidelines include:^{4,13}

- 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

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Automated External Defibrillation Algorithm

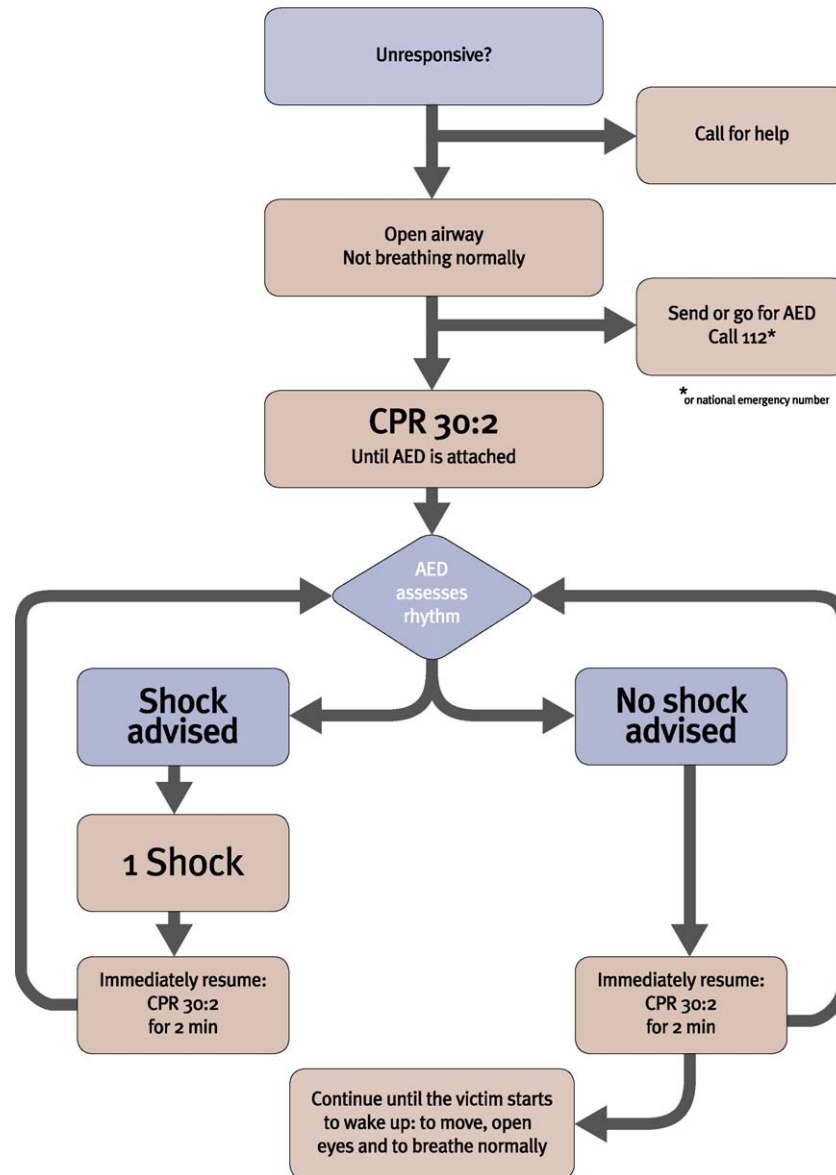


Fig. 1.4. AED algorithm. © 2010 ERC.

The full potential of AEDs has not yet been achieved, because they are used mostly in public settings, yet 60–80% of cardiac arrests occur at home. Public access defibrillation (PAD) and first responder AED programmes may increase the number of victims who receive bystander CPR and early defibrillation, thus improving survival from out-of-hospital SCA.⁹⁹ Recent data from nationwide studies in Japan and the USA^{33,100} showed that when an AED was available, victims were defibrillated much sooner and with a better chance of survival. Programmes that make AEDs publicly available in residential areas have not yet been evaluated. The acquisition of an AED for individual use at home, even for those considered at high risk of sudden cardiac arrest, has proved not to be effective.¹⁰¹

In-hospital use of AEDs

At the time of the 2010 Consensus on CPR Science Conference, there were no published randomised trials comparing in-hospital use of AEDs with manual defibrillators. Two lower-level studies of adults with in-hospital cardiac arrest from shockable rhythms

showed higher survival-to-hospital discharge rates when defibrillation was provided through an AED programme than with manual defibrillation alone.^{102,103} Despite limited evidence, AEDs should be considered for the hospital setting as a way to facilitate early defibrillation (a goal of <3 min from collapse), especially in areas where healthcare providers have no rhythm recognition skills or where they use defibrillators infrequently. An effective system for training and retraining should be in place.¹⁰⁴ Enough healthcare providers should be trained to enable the first shock to be given within 3 min of collapse anywhere in the hospital. Hospitals should monitor collapse-to-first shock intervals and monitor resuscitation outcomes.

Shock in manual versus semi-automatic mode

Many AEDs can be operated in both manual and semi-automatic mode but few studies have compared these two options. The semi-automatic mode has been shown to reduce time to first shock when used both in-hospital¹⁰⁵ and pre-hospital¹⁰⁶ settings, and results

in higher VF conversion rates,¹⁰⁶ and delivery of fewer inappropriate shocks.¹⁰⁷ Conversely, semi-automatic modes result in less time spent performing chest compressions,^{107,108} mainly because of a longer pre-shock pause associated with automated rhythm analysis. Despite these differences, no overall difference in ROSC, survival, or discharge rate from hospital has been demonstrated in any study.^{105,106,109} The defibrillation mode that affords the best outcome will depend on the system, skills, training and ECG recognition skills of rescuers. A shorter pre-shock pause and lower total hands-off-ratio increases vital organ perfusion and the probability of ROSC.^{71,110,111} With manual defibrillators and some AEDs it is possible to perform chest compressions during charging and thereby reduce the pre-shock pause to less than 5 s. Trained individuals may deliver defibrillation in manual mode but frequent team training and ECG recognition skills are essential.

Strategies before defibrillation

Minimising the pre-shock pause

The delay between stopping chest compressions and delivery of the shock (the pre-shock pause) must be kept to an absolute minimum; even 5–10 s delay will reduce the chances of the shock being successful.^{71,110,112} The pre-shock pause can easily be reduced to less than 5 s by continuing compressions during charging of the defibrillator and by having an efficient team coordinated by a leader who communicates effectively. The safety check to ensure that nobody is in contact with the patient at the moment of defibrillation should be undertaken rapidly but efficiently. The negligible risk of a rescuer receiving an accidental shock is minimised even further if all rescuers wear gloves.¹¹³ The post-shock pause is minimised by resuming chest compressions immediately after shock delivery (see below). The entire process of defibrillation should be achievable with no more than a 5 s interruption to chest compressions.

Pads versus paddles

Self-adhesive defibrillation pads have practical benefits over paddles for routine monitoring and defibrillation.^{114–118} They are safe and effective and are preferable to standard defibrillation paddles.¹¹⁹

Fibrillation waveform analysis

It is possible to predict, with varying reliability, the success of defibrillation from the fibrillation waveform.^{120–139} If optimal defibrillation waveforms and the optimal timing of shock delivery can be determined in prospective studies, it should be possible to prevent the delivery of unsuccessful high energy shocks and minimise myocardial injury. This technology is under active development and investigation but current sensitivity and specificity is insufficient to enable introduction of VF waveform analysis into clinical practice.

CPR before defibrillation

Several studies have examined whether a period of CPR prior to defibrillation is beneficial, particularly in patients with an unwitnessed arrest or prolonged collapse without resuscitation. A review of evidence for the 2005 guidelines resulted in the recommendation that it was reasonable for EMS personnel to give a period of about 2 min of CPR before defibrillation in patients with prolonged collapse (>5 min).¹⁴⁰ This recommendation was based on clinical studies, which showed that when response times

exceeded 4–5 min, a period of 1.5–3 min of CPR before shock delivery improved ROSC, survival to hospital discharge^{141,142} and 1 year survival¹⁴² for adults with out-of-hospital VF or VT compared with immediate defibrillation.

More recently, two randomised controlled trials documented that a period of 1.5–3 min of CPR by EMS personnel before defibrillation did not improve ROSC or survival to hospital discharge in patients with out-of-hospital VF or pulseless VT, regardless of EMS response interval.^{143,144} Four other studies have also failed to demonstrate significant improvements in overall ROSC or survival to hospital discharge with an initial period of CPR,^{141,142,145,146} although one did show a higher rate of favourable neurological outcome at 30 days and 1 year after cardiac arrest.¹⁴⁵ Performing chest compressions while retrieving and charging a defibrillator has been shown to improve the probability of survival.¹⁴⁷

In any cardiac arrest they have not witnessed, EMS personnel should provide good-quality CPR while a defibrillator is retrieved, applied and charged, but routine delivery of a specified period of CPR (e.g., 2 or 3 min) before rhythm analysis and a shock is delivered is not recommended. Some emergency medical services have already fully implemented a 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.

Delivery of defibrillation

One shock versus three-stacked shock sequence

Interruptions in external chest compression reduces the chances of converting VF to another rhythm.⁷¹ Studies have shown a significantly lower hands-off-ratio with a one-shock instead of a three-stacked shock protocol¹⁴⁸ and some,^{149–151} but not all,^{148,152} have suggested a significant survival benefit from this single-shock strategy.

When defibrillation is warranted, give a single shock and resume chest compressions immediately following the shock. Do not delay CPR for rhythm analysis or a pulse check immediately after a shock. **Continue CPR (30 compressions:2 ventilations) for 2 min until rhythm analysis is undertaken and another shock given** (if indicated) (see *Advanced life support*).⁶

If VF/VT occurs during cardiac catheterisation or in the early post-operative period following cardiac surgery (when chest compressions could disrupt vascular sutures), consider delivering up to three-stacked shocks before starting chest compressions (see *Special circumstances*).¹⁰ This three-shock strategy may also be considered for an initial, witnessed VF/VT cardiac arrest if the patient is already connected to a manual defibrillator. Although there are no data supporting a three-shock strategy in any of these circumstances, it is unlikely that chest compressions will improve the already very high chance of return of spontaneous circulation when defibrillation occurs early in the electrical phase, immediately after onset of VF.

Waveforms

Monophasic defibrillators are no longer manufactured, and although many will remain in use for several years, biphasic defibrillators have now superseded them.

Monophasic versus biphasic defibrillation

Although biphasic waveforms are more effective at terminating ventricular arrhythmias at lower energy levels, have demonstrated greater first shock efficacy than monophasic waveforms, and have greater first shock efficacy for long duration VF/VT.^{153–155} No randomised studies have demonstrated superiority in terms of