The use of Automated External Defibrillators

Introduction

This section contains guidelines for the use of automated external defibrillators (AEDs) by laypeople, first responders, and healthcare professionals responding with an AED out of hospital. These guidelines are appropriate for all AEDs, including those that are fully automatic. Guidelines for in-hospital use of manual defibrillators are in the adult advanced life support (ALS) section.

Sudden cardiac arrest is a leading cause of death in Europe, affecting about 700,000 individuals a year.[1] Many victims of sudden cardiac arrest can survive if bystanders act immediately while ventricular fibrillation (VF) is still present; successful resuscitation is unlikely once the rhythm has deteriorated to asystole.[2]

Electrical defibrillation is well established as the only effective therapy for cardiac arrest caused by VF or pulseless ventricular tachycardia (VT). The scientific evidence to support early defibrillation is overwhelming; the delay from collapse to delivery of the first shock is the single most important determinant of survival. The chances of successful defibrillation decline at a rate of 7-10% with each minute of delay; basic life support will help to maintain a shockable rhythm but is not a definitive treatment.

The Resuscitation Council (UK) strongly recommends a policy of early attempted defibrillation.

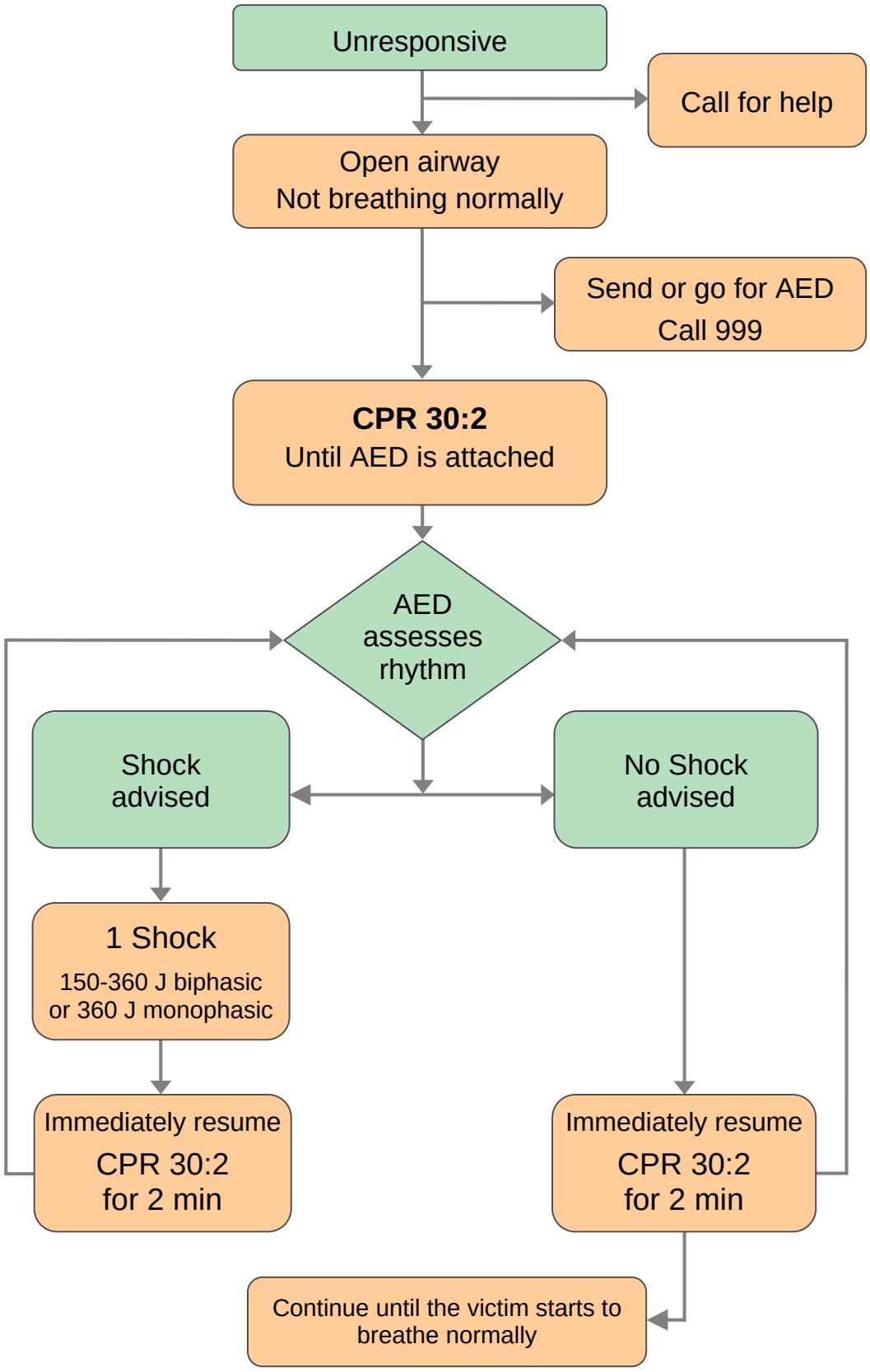
Guideline changes

Although Guidelines 2005 contain recommendations for changes in the sequence of shock delivery, there are no fundamental changes to the sequence of actions, since users should be taught to determine the need for an AED, switch on the machine, attach the electrodes, and follow the prompts.

The main guideline changes are:

1) Place the axillary electrode pad vertically to improve efficiency.
2) If possible, continue CPR whilst the pads are being applied.
3) Program AEDs to deliver a single shock followed by a pause of 2 min for the immediate resumption of CPR (see adult ALS section).

AED Algorithm



Types of AEDs

AEDs are sophisticated, reliable, safe, computerised devices that deliver defibrillatory shocks to victims of cardiac arrest. They use voice and visual prompts to guide rescuers, and are suitable for use by lay rescuers and healthcare professionals. There are two types of AED: most are semi-automatic, but a few fully-automatic AEDs are available. All AEDs analyse the victim's rhythm, determine the need for a shock, and then deliver a shock. A semi-automatic AED advises the need for a shock, but this has to be delivered by the operator when prompted. Some semi-automatic AEDs have the facility to enable the operator (normally a healthcare professional) to override the device and deliver a shock manually, independently of any prompts.

Sequence of actions when using an AED

The following sequence is for the use of both semi-automatic and automatic AEDs.

1 Make sure the victim, any bystanders, and you are safe.

- If two rescuers are present, assign tasks.

2 If the victim is unresponsive and not breathing normally:

- Send someone for the AED and to call for an ambulance. If you are on your own do this yourself; you may need to leave the victim.

3 Start CPR according to the guidelines for BLS.

4 As soon as the AED arrives:

- Switch on the AED and attach the electrode pads. If more than one rescuer is present, continue CPR whilst this is done. (Some AEDs may automatically switch on when the AED lid is opened).
- Follow the voice / visual prompts.
- Ensure that nobody touches the victim whilst the AED is analysing the rhythm.

5 A If a shock <u>is</u> indicated:

- Ensure that nobody touches the victim.
- Push the shock button as directed.
  (Fully-automatic AEDs will deliver the shock automatically).
- Continue as directed by the voice / visual prompts.

5 B If <u>no</u> shock is indicated:

- Immediately resume CPR using a ratio of 30 compressions to 2 rescue breaths.
- Continue as directed by the voice / visual prompts.

6 Continue to follow the AED prompts until:

- qualified help arrives and takes over,
- the victim starts to breathe normally, or
- you become exhausted.

Placement of AED pads

The victim's chest must be sufficiently exposed to enable correct electrode pad placement. Chest hair will prevent the pads adhering to the skin and will interfere with electrical contact. Shave the chest only if the hair is excessive, and even then spend as little time as possible on this. Do not delay defibrillation if a razor is not immediately available.

Place one AED pad to the right of the sternum, below the clavicle. Place the other pad in the mid-axillary line, approximately level with the V6 ECG electrode position or the female breast. This position should be clear of any breast tissue. It is important that this electrode is placed sufficiently laterally. In order to improve efficiency, place the mid-axillary pad with its long axis vertical.[3]

Although most AED pads are labelled left and right, or carry a picture of their correct placement, it does not matter if they are reversed. It is important to teach that if an 'error' is made, the pads should not be removed and replaced as this wastes time and they may well not adhere adequately when re-attached.

CPR before defibrillation

Immediate defibrillation, as soon as an AED becomes available, has always been a key element in guidelines and teaching. This concept has recently been challenged. There are studies showing that when the time between calling for an ambulance and its arrival exceeds 5 min, a period of chest compression before defibrillation may improve survival. However, in these studies CPR was performed by paramedics, who also protected the airway by intubation and delivered 100% oxygen. Similar results may not be achievable by lay responders. For this reason Guidelines 2005 continues to recommend an immediate shock as soon as the AED is available.

Voice prompts

Voice prompts are usually programmable and it is recommended that they be set as follows:

- a single shock only when a shockable rhythm is detected;
- no rhythm, breathing, or pulse check after the shock;
- a voice prompt for immediate resumption of CPR after the shock;
- two min allowed for CPR before a voice prompt to assess the rhythm, breathing, or a pulse is given.

AED use by healthcare professionals

All healthcare professionals should consider the use of an AED to be an integral component of basic life support. Early defibrillation should be available throughout all hospitals, outpatient medical facilities, and clinics. An adequate number of staff should be trained to enable a first shock to be provided within 3 min of collapse anywhere in the hospital. Hospitals should monitor collapse-to-first-shock intervals and monitor resuscitation outcomes.

AED use by trained lay first responders

AEDs should be deployed within a medically-controlled system under the direction of a medical adviser. This may be a doctor from any medical discipline who has clinical expertise in resuscitation. Medical advisers should be career-grade doctors including consultants, GP principals, and other equivalents in the Voluntary Aid Societies, commercial and charitable organisations, and the Defence Medical Services. The 'medical director/adviser' is responsible for ensuring that controls are in place to ensure adequate training of AED users, with periodic refresher training. This training and retraining must be provided by appropriately qualified individuals, for example resuscitation training officers, community defibrillation officers, medical or nursing staff, ambulance service trainers, and other individuals such as first aid trainers accredited in AED training. Basic life support skills must also be taught, assessed, and refreshed in accordance with current guidelines.

Children

Smaller, paediatric, self-adhesive pads, that attenuate the delivered current during defibrillation, are available for use with AEDs. Standard AEDs are suitable for use in children older than 8 years. In children between 1 and 8 years paediatric pads or a paediatric mode should be used if available; if not, the AED should be used as it is. There is insufficient evidence to support a recommendation for or against the use of AEDs in children less than 1 year.

Public access defibrillation (PAD)

Public access defibrillation (PAD) and first-responder programmes are now widespread. An important factor contributing to the high success rates of PAD is the short response time from collapse to resuscitation.[4] Some ambulance trusts have reduced the time to defibrillation by using trained, lay, responders. Although such a strategy has been reported to improve the incidence of return of spontaneous circulation and survival to hospital admission, there is as yet limited evidence of increased survival to hospital discharge.[5] To have the greatest impact, such schemes should be introduced where the risk of cardiac arrest is highest. It has been suggested that for public access schemes to be cost-effective, the probability of cardiac arrest occurring in the location should be at least once every two years.[6]

References

1. Sans S, Kesteloot H, Kromhout D. The burden of cardiovascular diseases mortality in Europe. Task Force of the European Society of Cardiology on Cardiovascular Mortality and Morbidity Statistics in Europe. Eur Heart J 1997;18:1231-48.

2. Larsen MP, Eisenberg MS, Cummins RO, Hallstrom AP. Predicting survival from out-of-hospital cardiac arrest: a graphic model. Ann Emerg Med 1993;22:1652-8.

3. Deakin CD, Sado DM, Petley GW, Clewlow F. Is the orientation of the apical defibrillation paddle of importance during manual external defibrillation? Resuscitation 2003;56:15-8.

4. Whitfield R, Colquhoun M, Newcombe R, Davies C. S, Boyle R. The Department of Health National Defibrillator Programme: analysis of downloads from 250 deployments of public access defibrillators. Resuscitation 2005;64:269 – 77.

5. Van Alem AP, Vrenken RH, de Vos R, Tijssen JG, Koster RW. Use of automated external defibrillator by first responders in out of hospital cardiac arrest: prospective controlled trial. BMJ 2003;327:1312.

6. Becker DE. Assessment and management of cardiovascular urgencies and emergencies: cognitive and technical considerations. Anaesthesia Progress 1988;35:212-7.