Defibrillation 1: using an AED outside hospital

The first of a two-part series on defibrillation explores the use of automated external defibrillators outside hospitals, and explains why they can be used without training.

**In this article...**
- The importance of prompt defibrillation in cardiac arrest outside the hospital setting
- An introduction to automated external defibrillators (AEDs), including types, preparation for use and maintenance
- How to defibrillate a patient in cardiac arrest using an AED

**5 key points**
1. Most out-of-hospital cardiac arrests are caused by ventricular fibrillation or pulseless ventricular tachycardia.
2. Prompt defibrillation can achieve survival rates as high as 75%. The chances of successful defibrillation decline by around 10% with each minute of delay.
3. Automated external defibrillators (AEDs) are sophisticated, computerised devices that deliver defibrillatory shocks to a person in cardiopulmonary arrest.
4. Before starting defibrillation, the patient’s chest should be exposed to allow correct placement of AED pads, and the chest should be dried if it is clammy or wet.
5. All healthcare staff should be trained, equipped, and encouraged to perform defibrillation. AEDs should be easily accessible and not locked away.

Ambulance response standards require an ambulance to reach 75% of cardiac arrests within eight minutes. However, unless bystander cardiopulmonary resuscitation (CPR) and defibrillation are performed in the meantime, this is likely to be too late (Lambert, 2006). If both procedures are performed promptly, thousands of lives would be saved in the UK every year (Virdi et al, 2010).

All healthcare staff, including practice nurses, community nurses and health visitors, have a duty to perform effective CPR on their patients if required. According to Deakin et al (2010), they should also be trained, equipped and encouraged to perform defibrillation.

The RCUK (200a) says automated external defibrillators (AEDs) can be used safely and effectively without previous training. They recommend that all healthcare personnel use these devices when attending a cardiac arrest outside hospital.

**Box 1. Definition of defibrillation**

“The passage of an electrical current across the myocardium of sufficient magnitude to depolarise a critical mass of myocardium, and enable restoration of coordinated electrical activity”

Source: Deakin et al (2010)
Automated external defibrillators

Although there is no statutory requirement under English or Welsh law to provide defibrillators, there are implications under common law if a public facility does not provide adequate safeguards to protect the public (RCUK, 2008b; 2010c; Day et al, 2008).

It is recommended that all UK healthcare practices are equipped with AEDs, and that most health professionals should be trained to use them (RCUK, 2005).

AEDs are becoming increasingly available in public places, such as railway stations, airports and shopping centres. They are also used in some hospitals, usually where there is no cardiac arrest team cover, and the local procedure is to call 999 for an ambulance.

The use of AEDs has been extended to in-hospital cardiac arrests, with staff being trained to defibrillate with an AED before the cardiac arrest team arrives (Spearpoint et al, 2009). The use of AEDs in hospital will be discussed in the next article.

Types of AEDs

AEDs are sophisticated, reliable, safe, computerised devices that deliver defibrillatory shocks to a person in cardiopulmonary arrest (RCUK, 2010a) (Fig 1). Voice or visual prompts to guide the operator mean they can be used easily by both health professionals and lay people. AEDs eliminate the need for training in the complex skills of ECG recognition, considerably increasing the range of people who can operate them (Lambert, 2006).

AEDs are classified as either semi-automated or automated:

» Automated AED: this analyses the ECG, advises that a shock is required, charges up automatically and prompts the operator to press the ’shock button’ to defibrillate the patient;

» Semi-automated AED: this analyses the ECG, then charges up and delivers the shock automatically without the operator having to press a shock button.

Defibrillator technology is rapidly evolving; AED interaction with the rescuer through voice prompts is now established, and future technology may enable AEDs to give more specific instructions to the user (Deakin et al, 2010).

AED preparation

It is important to expose the patient’s chest sufficiently to allow correct placement of AED pads. If the chest is clammy or wet, it should be dried quickly. Ideally, excessive chest hair should be removed using a razor, though defibrillation should not be delayed if one is not immediately available (RCUK, 2010a).

AED pads are designed to stick to the chest, allowing ECG analysis and providing an effective interface with the patient’s skin.

The standard positions for the pads are:

» To the right of the sternum and just below the clavicle;

» Left mid-axillary line, where the V6 ECG electrode is positioned, ensuring it avoids breast tissue (Fig 2).

The majority of AED pads have a picture on them advising the user of their correct placement; it does not matter if the positions are reversed (RCUK, 2010a).

1. Confirm cardiac arrest, start CPR (chest compressions first) while one person calls 999 for an ambulance and another fetches the AED.
2. Once the AED arrives, switch it on and follow the audio and/or visual instructions. CPR should be continued.
3. Expose the patient’s chest, quickly dry the skin and shave the chest if necessary, and apply AED pads as instructed. Colleagues should continue with CPR.
4. Apply the self-adhesive AED pads to the chest following the instructions. Some models require the operator to connect the leads attached to the pads to the AED, but leads are already attached in most. CPR should be continued.
5. Once the AED starts to analyse the patient’s ECG, stop CPR and follow the prompts. Some AEDs require the operator to press an “analyse” button, but most automatically begin ECG analysis once the pads are attached to the patient’s chest. Ensure nobody is touching the patient during analysis.
6. If shock is advised, shout “stand clear” and perform a quick visual check to ensure all staff are clear.
7. Press the shock button. Automated AEDs will deliver the shock automatically.
8. Continue CPR: 30 compressions to two ventilations as guided by the AED prompts.
9. Continue to follow the AED prompts until qualified help arrives and takes over or the patient starts to display signs of regaining consciousness, such as coughing, opening the eyes, talking or moving purposefully, as well as starting to breathe normally.

Source: RCUK (2010a) Based on the algorithm for automated external defibrillation (Fig 3)

Children over eight years old: standard adult-sized AED pads should be used
Children aged 1-8 years: ideally, paediatric AED pads that attenuate the current should be used. If these are not available, adult-sized pads can be used
Infants and children under one year of age: AED use is not recommended but may be considered if it is the only defibrillator available. Ideally, it should be used with paediatric pads

Source: RCUK (2000a)

BOX 2. PROCEDURE FOR USING AN AED

BOX 3. AEDS IN CHILDREN

FIG 1. AN AED DEVICE

FIG 2. AED PAD POSITIONS

www.nursingtimes.net / Vol 107 No 38 / Nursing Times 27.09.11 15
If the patient has an implanted medical device, such as a permanent pacemaker or implantable cardioverter defibrillator (ICD), ensure the defibrillation electrodes are placed at least 8 cm from the pacing or ICD device to minimise the risk of the current travelling along the pacing wire or ICD lead (RCUK, 2011).

Before delivering a shock using an AED, it is essential to ensure nobody is touching the patient and nothing is connected to them. Temporarily remove oxygen delivery devices such as oxygen masks or nasal canulas, and position them at least one metre from the patient (Resuscitation Council (UK), 2011).

The procedure for AED is outlined in Box 2 and Fig 3 and its use in children in Box 3.

**AED maintenance**

Practice managers or practice nurses are usually responsible for the maintenance of AEDs in health centres (Day et al, 2008). The devices should be easily accessible and standard AED signs should show where they are.

AEDs should be checked and maintained following the manufacturer’s recommendations. This usually involves regular checks to ensure the AED is “rescue ready” and that the pads are not out of date, or periodically switching it on. AEDs generally undertake self-checks on a regular basis, and will alert staff if there is a problem, such as the battery getting low, by making a beeping noise.

**AED training**

Training and retraining in the use of AEDs is variable. A survey by Day et al (2008) showed that, in over half of health centres that had an AED, clinical staff had not received AED update training. Poor retention of resuscitation skills following training for both nursing and medical staff is well documented, and regular updates are required to maintain competence and proficiency (Hamilton, 2005; Woollard et al, 2004).

The RCUK (2010a) guidelines contain two key statements regarding training in the use of an AED:

» As AEDs can be safely and effectively used without previous training, their use should not be restricted to those trained in their use. However, training is still advocated because user awareness should instil confidence, ensure correct positioning of electrodes and speed up delivery of the first shock;

» Validated short video/computer self-instruction courses, which involve only minimal or even no training by an instructor as well as hands-on practice, may be considered as an alternative to instructor-led CPR/AED courses.

**Conclusion**

Cardiac arrests are common outside hospitals. Most are caused by VF or VT and rapid defibrillation is the definitive treatment. AEDs are widely available, and primary healthcare staff should be familiar with how to use them and not hesitate to do so when necessary.

**References**


