Keywords Resuscitation/Out of hospital/Defibrillator

This article has been double-blind peer reviewed

Out-of-hospital resuscitation 2: automated external defibrillator

Author Emma Hammett is chief executive officer, First Aid for Life.

Abstract Many nurses will be familiar with the defibrillator on a resuscitation trolley in hospitals but may be less confident to use one as part of a resuscitation attempt outside of the hospital setting. This article, the second in a four-part series on basic life support, describes how to use an automated external defibrillator. Part one described how to perform cardiopulmonary resuscitation.

Citation Hammett E (2021) Out-of-hospital resuscitation 2: automated external defibrillator. *Nursing Times* [online], 117: 10, 42-44.

More than 30,000 people in Britain every year have a cardiac arrest in the community (British Heart Foundation, 2014). The London Ambulance Service NHS Trust (2019) reported that, in the year 2018-2019, 73% of out-of-hospital cardiac arrests happened in private locations (at home or in care homes) and 27% occurred in a public place. It is vital that anyone experiencing a cardiac arrest receives immediate, appropriate treatment with effective cardiopulmonary resuscitation (CPR) and automated external defibrillation.

Immediate, effective CPR improves survival and post-arrest quality of life (Perkins et al, 2016). Research has shown that deploying an automated external defibrillator (AED) within 3-5 minutes of collapse can result in survival rates as high as 50-70% but each minute of delay to defibrillation, in patients with a shockable rhythm, reduces the probability of survival to hospital discharge by 10% (BHF, 2017). Historically many registered nurses were not taught first aid, but this is changing as the Nursing and Midwifery Council (NMC) (2018) now requires that nurses learn skills in basic physical first aid.

This series provides an update on basic life support for out-of-hospital cardiac arrest and adheres to Resuscitation Council UK (RCUK) guidance by Perkins et al (2021). Management of cardiac arrest in patients with known or suspected Covid-19 is not included in the updated RCUK resuscitation guidance and is covered separately in a Covid-19 statement (Bit.ly/RCUKCovCPR) as seen in part 1 of this series (Hammett, 2021). It is important that nurses are also aware of guidance from the NMC (2017) and the Royal College of Nursing's duty of care (Bit.ly/RCNDutyofCare) for nurses to act as a "good Samaritan", which are outlined in Part 1.

Fig 1. **Ventricular fibrillation**

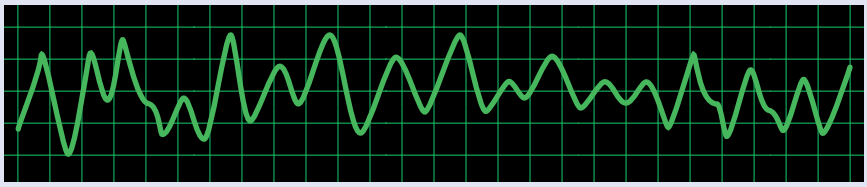


Fig 2. **Ventricular tachycardia**

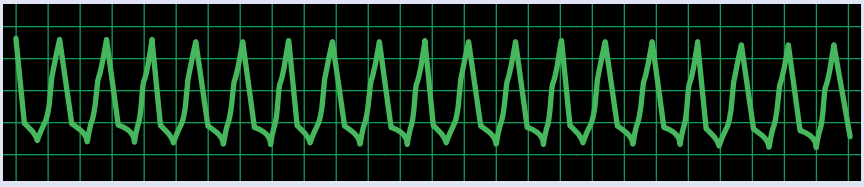
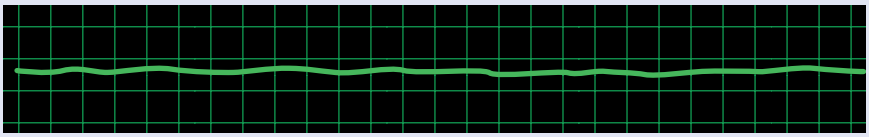


Fig 3. **Asystole**



JENNIFER N.R. SMITH

How a defibrillator works

The contraction and relaxation of the heart is regulated by electrical impulses originating in the sinoatrial node. The heart usually pumps at a regular rate of 60-100 beats per minute. Abnormal heart rhythms can occur for a number of reasons including in response to myocardial infarction and cardiomyopathies (Jarvis, 2021). Some rhythms, such as ventricular tachycardia (VT) and ventricular fibrillation (VF), interfere with the effective pumping of blood around the body and can lead to collapse and loss of life. Jarvis (2021) provides an overview of cardiac rhythm and conduction abnormalities.

An AED uses an electrical current to depolarise the electrical system of the heart. This enables the natural pacemaker of the heart, the sinoatrial node, to resume control and return the heart to sinus rhythm – similar to rebooting a computer. An AED will only allow you to administer a shock when someone is in VF (Fig 1) or VT (Fig 2). It will not advise a shock if the casualty is in sinus rhythm or asystole, where no pulse is present (Fig 3).

Where to find an AED

AEDs are accessible at numerous locations, including: train and tube stations, shopping centres, dental and GP practices,

sports grounds and leisure centres. They are designed so any member of the public can use them, and may be:

- Semi-automatic (the rescuer needs to press the shock button when indicated);
- Fully automatic (the machine shocks automatically when a shock is advised).

In the UK, there are no legal restrictions on using an AED. A rescuer, whether a trained first aider or an untrained member of the public, who has acted to the best of their ability to help a person in cardiac arrest, should not be sued when using an AED, no matter what the outcome.

Ambulance services should have information on defibrillator locations, either through regional databases or national databases (Perkins et al, 2021). Various apps, such as PulsePoint AED and GoodSAM, can also be used to locate your nearest defibrillator. Examples of location signs for an AED are shown in Fig 4.

Fig 4. **Signs showing location of AED**

Source: Resuscitation Council (UK) and the British Heart Foundation

Using an AED

When you find a collapsed casualty you must consider the following:

- *Danger* – do not put yourself in danger;
- *Response* – if the patient is not responding, shout for help and, if possible, get a bystander to call for an ambulance and locate a defibrillator;
- *Airway* – open the airway and check for breathing;
- *Breathing* – if the casualty does not appear to be breathing normally and there are less than two breaths in a 10-second period, you should contact emergency services and start CPR;
- *If you are on your own* – call 999 or 112 and put the phone on speaker while you give CPR;
- *If you have help* – ask your bystander to let the emergency services know the casualty is unconscious and not breathing, and to bring an AED as quickly as possible. It is important to continue CPR while waiting for the defibrillator.

When the AED arrives, it should be activated by opening the lid or pressing an obvious button. It will then provide verbal or visual instructions. The AED should come with pads, scissors, a pocket mask, razor and something to dry the chest.

If there are two of you

One should continue with CPR, while the other:

1. Attaches the chest leads to the AED if they are not already connected;

2. Dries the chest (if clammy) to help the pads stick to the skin;

3. Shaves the chest using a disposal razor provided (only necessary if the area is excessively hairy and likely to impede the AED pads' adherence);

4. Peel the backing off one chest pad and place below the casualty's right collar bone. The position is indicated on the pad or AED (Perkins et al, 2021) (Fig 5a);

5. Peel the backing off the second chest pad and place on the casualty's left-hand side, over their lower ribs as indicated on the pad or AED (Perkins et al, 2021) (Fig 5b). Fig 5c shows both pads in place.

6. Stop CPR and ensure no one is touching the casualty while the AED analyses the heart rhythm.

If you realise you have put the pads on the wrong way round, do not remove them as the AED will still work; if the AED offers a trace, this may appear upside down, but this will not affect the functioning of the machine.

If a shock is advised

1. Check the whole length of the casualty to ensure no one is touching them. Loudly shout **"stand clear"**.

2. Once you are sure no one is touching the casualty, press the flashing shock button as directed (fully automated AEDs will do this automatically once a shock is advised).

3. Once the shock has been delivered, continue with CPR: 30 compressions to two breaths. Keep any time without CPR to an absolute minimum.

4. Do not stop to check for signs of life. Only cease CPR if the casualty begins to regain consciousness and starts breathing normally.

5. The machine will request you to stop compressions for it to reassess the heart rhythm every two minutes. It will indicate another shock if one should be given.

6. Keep going until help arrives, you are too exhausted to continue, or the casualty begins to regain consciousness and starts to breathe normally.

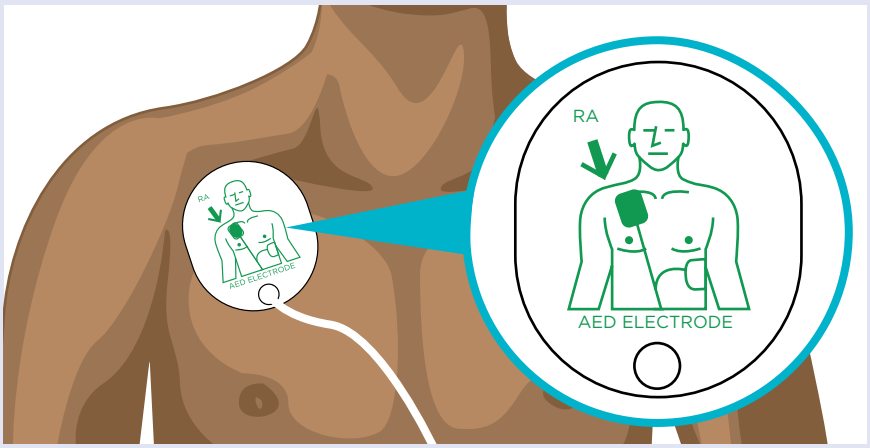
If no shock is advised

- Continue with CPR and follow prompts from the AED;
- Keep going until help arrives, you are too exhausted to continue, or the casualty begins to regain consciousness and starts to breathe normally;
- The AED will reassess the heart rhythm every two minutes and advise a shock if necessary;
- Do not remove the pads as the casualty could revert back into a shockable rhythm.

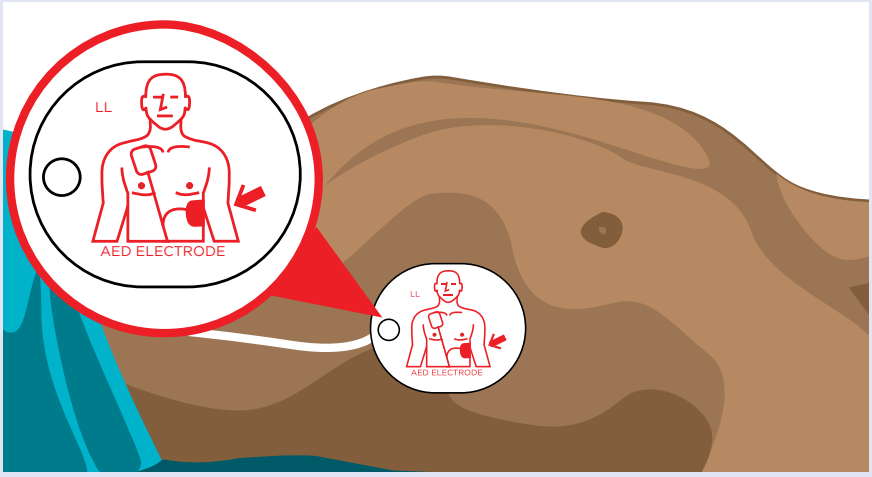
Safety considerations when using an AED

- *Electric shock* – the risk from an AED is extremely small, however, it is always sensible to check no one is touching the casualty when the shock is given;
- *Jewellery* – avoid placing the pads over metal jewellery, as it can conduct electricity and burn the casualty. Jewellery does not need to be removed;
- *Medication patches* – remove any

Fig 5. **Position of AED chest pads**



5a. Place the first chest pad below the casualty's right collar bone



5b. Place the second pad on the casualty's left-hand side, over their lower ribs

5c. Both pads in place

JENNIFER N.R. SMITH, ALAMY

obvious medication patches on the casualty's chest and do not place pads over them. Glyceryl trinitrate patches (which are used to treat angina) could explode if a shock passed over them;

- *Implanted devices* – most pacemakers are on the left-hand side of the chest. Do not place pads over strange bumps or scars, which may indicate the location of an implant;
- *Breast tissue* – ideally pads should not be placed directly on breast tissue as this could reduce the conduction;
- *Flammable atmosphere* – turn off any piped oxygen because of the risk of fire, or put it at least two metres from the casualty while shocking. Do not use an AED in the presence of petrol fumes.

Information for paramedics

When the paramedics arrive, they will need to know:

- What happened;
- How long you have been doing CPR;
- Whether a shock was advised by the AED and, if so, how many shocks have been given;
- Any medication patches that were removed prior to using AED.

Following the incident

It is normal to feel any of the following;

- Elation and an adrenaline buzz;
- Anger;
- Confusion;
- Flashbacks and bad dreams;
- Depression.

Dealing with a medical emergency in an unfamiliar situation can be extremely stressful and it is important to remember that some people need professional help and counselling after such an episode. **NT**

References

British Heart Foundation (2017) *Resuscitation to Recovery: A National Framework to Improve Care of People with Out-of-hospital Cardiac Arrest (OHCA) in England.* BHF.

British Heart Foundation (2014) *We Fight for every Heartbeat: Our Strategy to 2020.* BHF

Hammett E (2021) Out-of hospital resuscitation 1: adult basic life support. *Nursing Times* [online]; 117: 9; 27-30.

Jarvis S (2021) Electrocardiogram 3: cardiac rhythm and conduction abnormalities. *Nursing Times* [online]; 117: 8, 27-32.

London Ambulance Service NHS Trust (2019) *Cardiac Arrest Annual Report: 2018/19.* LASNHST.

Nursing and Midwifery Council (2018) *The Code. Professional Standards of Practice and Behaviour for Nurses, Midwives and Nursing Associates.* NMC

Nursing and Midwifery Council (2017) Information for nurses and midwives on responding to unexpected incidents or emergencies. *nmc.org.uk,* 16 August.

Perkins GD et al (2021) *Adult Basic Life Support Guidelines.* Resuscitation Council UK.

Perkins GD et al (2016) National initiatives to improve outcomes from out-of-hospital cardiac arrest in England. *Emergency Medicine Journal:* 33: 7, 448-451.

Professional responsibilities

This procedure should be undertaken only after approved training, supervised practice and competency assessment, and carried out in accordance with local policies and protocols.

CLINICAL SERIES **Out-of-hospital resuscitation**

Part 1: Adult basic life support	Sep
Part 2: Automatic external defibrillators	Oct
Part 3: Paediatric basic life support	Nov
Part 4: Recovery position	Dec