

Basic Life Support and Automated External Defibrillation

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Learning Objectives

1. Understand the concept and importance of the chain of survival
2. Know how to assess a person who is unresponsive
3. Know how to perform CPR on a person in cardiac arrest
4. Know how to use an automated external defibrillator (AED)
5. Know how to put a patient into the recovery position
6. Know how to deal with a person who is choking

Introduction

The community response to cardiac arrest is critical to saving lives. Each year, UK ambulance services respond to approximately 60,000 cases of suspected cardiac arrest. Resuscitation is attempted by ambulance services in less than half of these cases (approximately 28,000).³ The main reasons are that either the victim has been dead for several hours or has not received bystander CPR so by the time the emergency services arrive the person has died. Even when resuscitation is attempted, less than one in ten victims survive to go home from hospital. Strengthening the community response to cardiac arrest by training and empowering more bystanders to perform CPR and by increasing the use of automated external defibrillators (AEDs) at least doubles the chances of survival and could save thousands of lives each year.^{4,5}

Chain of Survival

The Chain of Survival (Figure 1) describes four key, inter-related steps, which if delivered effectively and in sequence, optimise survival from out-of-hospital cardiac arrest.⁷

1: Early recognition and call for help

If untreated, cardiac arrest occurs in a quarter to a third of patients with myocardial ischaemia within the first hour after onset of chest pain. Once cardiac arrest has occurred, early recognition is critical to enable rapid activation of the ambulance service and prompt initiation of bystander CPR.

2: Early bystander CPR

The immediate initiation of bystander CPR can double or quadruple survival from out-of-hospital cardiac arrest.^{5,8-13} Despite this compelling evidence, only 40% of victims receive bystander CPR in the UK.¹⁴

3: Early defibrillation

Defibrillation within 3–5 min of collapse can produce survival rates as high as 50–70%.¹⁵ This can be achieved through public access defibrillation, when a bystander uses a nearby AED to deliver the first shock.^{4,15-17} Each minute of delay to defibrillation reduces the probability of survival to hospital discharge by 10%. In the UK, fewer than 2% of victims have an AED deployed before the ambulance arrives.¹⁸

4: Early advanced life support and standardised post-resuscitation care

Advanced life support with airway management, drugs and the correction of causal factors may be needed if initial attempts at resuscitation are unsuccessful. The quality of treatment during the post-resuscitation phase affects outcome and is addressed in the Adult advanced life support and Post-resuscitation care sections.¹⁹



Figure 1. The Chain of Survival

Key Messages

- Ensure it is safe to approach the victim.
- Promptly assess the unresponsive victim to determine if they are breathing normally.
- Be suspicious of cardiac arrest in any patient presenting with seizures and carefully assess whether the victim is breathing normally.
- For the victim who is unresponsive and not breathing normally:
 - Dial 999 and ask for an ambulance. If possible stay with the victim and get someone else to make the emergency call.
 - Start CPR and send for an AED as soon as possible.
 - If trained and able, combine chest compressions and rescue breaths, otherwise provide compression-only CPR.
 - If an AED arrives, switch it on and follow the instructions.
 - Minimise interruptions to CPR when attaching the AED pads to the victim.
- Do not stop CPR unless you are certain the victim has recovered and is breathing normally or a health professional tells you to stop
- Treat the victim who is choking by encouraging them to cough. If the victim deteriorates give up to 5 back slaps followed by up to 5 abdominal thrusts. If the victim becomes unconscious – start CPR.
- The same steps can be followed for resuscitation of children by those who are not specifically trained in resuscitation for children – it is far better to use the adult BLS sequence for resuscitation of a child than to do nothing.

Adult BLS Sequence

The sequence of steps for the initial assessment and treatment of the unresponsive victim are summarised in Figure 2. Further technical information on each of the steps is presented in Table 1 and below.

The sequence of steps takes the reader through recognition of cardiac arrest, calling an ambulance, starting CPR and using an AED. The number of steps has been reduced to focus on the key actions. The intent of the algorithm is to present the steps in a logical and concise manner that is easy for all types of rescuers to learn, remember and perform CPR and use an AED.

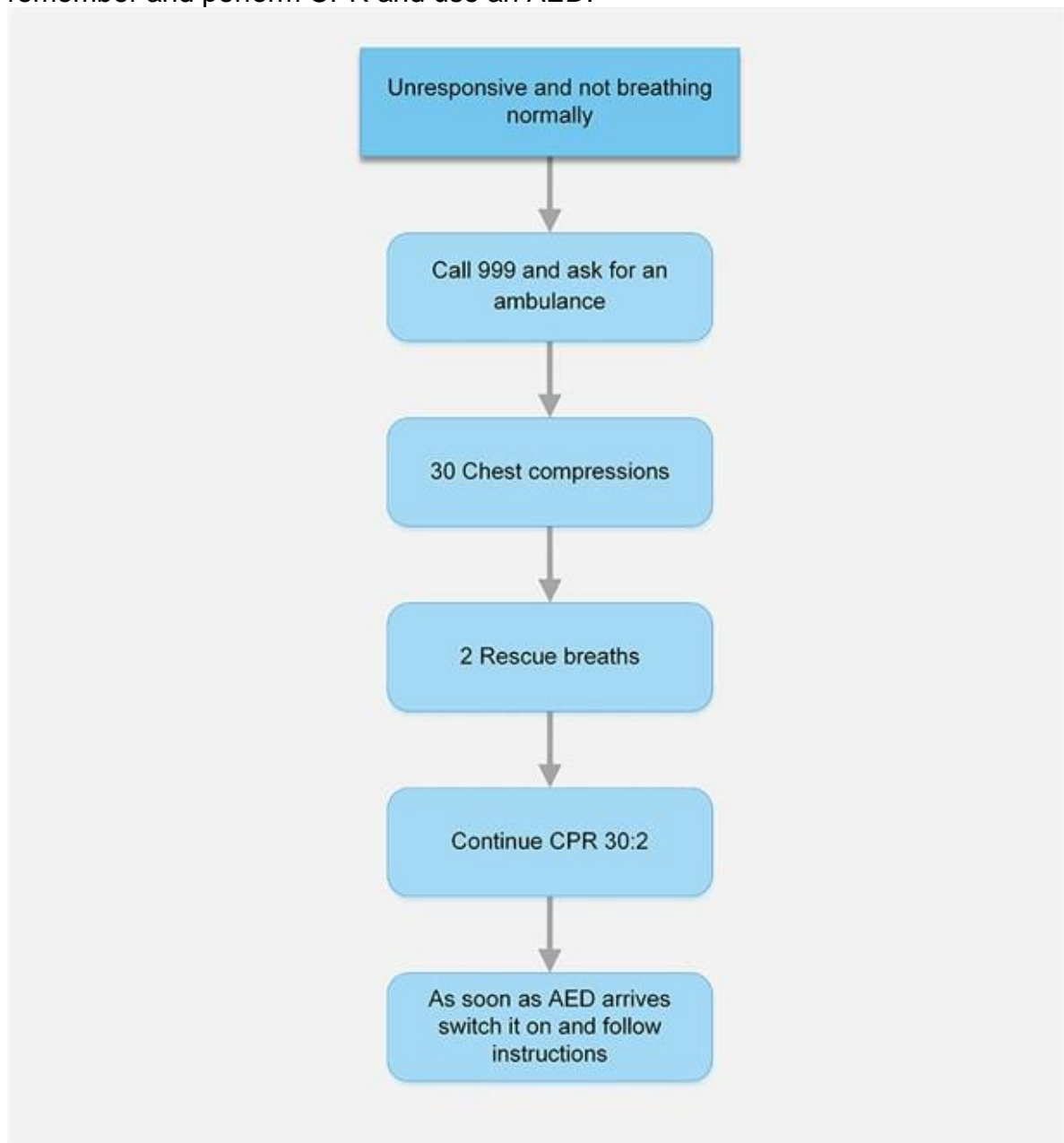


Figure 2. Adult basic life support algorithm

Table 1: BLS/AED detailed sequence of steps

SEQUENCE	Technical description
SAFETY	Make sure you, the victim and any bystanders are safe
RESPONSE	Check the victim for a response <ul style="list-style-type: none"> • Gently shake his shoulders and ask loudly: "Are you all right?" <p>If he responds leave him in the position in which you find him, provided there is no further danger; try to find out what is wrong with him and get help if needed; reassess him regularly</p>
AIRWAY	Open the airway <ul style="list-style-type: none"> • Turn the victim onto his back • Place your hand on his forehead and gently tilt his head back; with your fingertips under the point of the victim's chin, lift the chin to open the airway
BREATHING	Look, listen and feel for normal breathing for no more than 10 seconds <p>In the first few minutes after cardiac arrest, a victim may be barely breathing, or taking infrequent, slow and noisy gasps. Do not confuse this with normal breathing. If you have any doubt whether breathing is normal, act as if it is they are not breathing normally and prepare to start CPR</p>
DIAL 999	Call an ambulance (999) <ul style="list-style-type: none"> • Ask a helper to call if possible otherwise call them yourself • Stay with the victim when making the call if possible • Activate the speaker function on the phone to aid communication with the ambulance service
SEND FOR AED	Send someone to get an AED if available <p>If you are on your own, do not leave the victim, start CPR</p>

<p>CIRCULATION</p>	<p>Start chest compressions</p> <ul style="list-style-type: none"> • Kneel by the side of the victim • Place the heel of one hand in the centre of the victim's chest; (which is the lower half of the victim's breastbone (sternum)). Place the heel of your other hand on top of the first hand • Interlock the fingers of your hands and ensure that pressure is not applied over the victim's ribs. Keep your arms straight • Do not apply any pressure over the upper abdomen or the bottom end of the bony sternum (breastbone) • Position your shoulders vertically above the victim's chest and press down on the sternum to a depth of 5–6 cm • After each compression, release all the pressure on the chest without losing contact between your hands and the sternum; • Repeat at a rate of 100–120 min⁻¹
<p>GIVE RESCUE BREATHS</p>	<p>After 30 compressions open the airway again using head tilt and chin lift and give 2 rescue breaths</p> <ul style="list-style-type: none"> • Pinch the soft part of the nose closed, using the index finger and thumb of your hand on the forehead • Allow the mouth to open, but maintain chin lift • Take a normal breath and place your lips around his mouth, making sure that you have a good seal • Blow steadily into the mouth while watching for the chest to rise, taking about 1 second as in normal breathing; this is an effective rescue breath • Maintaining head tilt and chin lift, take your mouth away from the victim and watch for the chest to fall as air comes out • Take another normal breath and blow into the victim's mouth once more to achieve a total of two effective rescue breaths. Do not interrupt compressions by more than 10 seconds to deliver two breaths. Then return your hands without delay to the correct position on the sternum and give a further 30 chest compressions <p>Continue with chest compressions and rescue breaths in a ratio of 30:2</p> <p>If you are untrained or unable to do rescue breaths, give chest compression only CPR (i.e. continuous compressions at a rate of at least 100–120 min⁻¹)</p>

<p>IF AN AED ARRIVES</p>	<p>Switch on the AED</p> <ul style="list-style-type: none"> • Attach the electrode pads on the victim's bare chest • If more than one rescuer is present, CPR should be continued while electrode pads are being attached to the chest • Follow the spoken/visual directions • Ensure that nobody is touching the victim while the AED is analysing the rhythm <p>If a shock is indicated, deliver shock</p> <ul style="list-style-type: none"> • Ensure that nobody is touching the victim • Push shock button as directed (fully automatic AEDs will deliver the shock automatically) • Immediately restart CPR at a ratio of 30:2 • Continue as directed by the voice/visual prompts <p>If no shock is indicated, continue CPR</p> <ul style="list-style-type: none"> • Immediately resume CPR • Continue as directed by the voice/visual prompts
<p>CONTINUE CPR</p>	<p>Do not interrupt resuscitation until:</p> <ul style="list-style-type: none"> • A health professional tells you to stop • You become exhausted • The victim is definitely waking up, moving, opening eyes and breathing normally <p>It is rare for CPR alone to restart the heart. Unless you are certain the person has recovered continue CPR</p>

**RECOVERY
POSITION****If you are certain the victim is breathing normally but is still unresponsive, place in the recovery position**

- Remove the victim's glasses, if worn
- Kneel beside the victim and make sure that both his legs are straight
- Place the arm nearest to you out at right angles to his body, elbow bent with the hand palm-up
- Bring the far arm across the chest, and hold the back of the hand against the victim's cheek nearest to you
- With your other hand, grasp the far leg just above the knee and pull it up, keeping the foot on the ground
- Keeping his hand pressed against his cheek, pull on the far leg to roll the victim towards you on to his side
- Adjust the upper leg so that both the hip and knee are bent at right angles
- Tilt the head back to make sure that the airway remains open
- If necessary, adjust the hand under the cheek to keep the head tilted and facing downwards to allow liquid material to drain from the mouth
- Check breathing regularly

Be prepared to restart CPR immediately if the victim deteriorates or stops breathing normally

A video of putting someone into the recovery position can be found at <https://www.nhs.uk/conditions/first-aid/recovery-position/>

Use of an automated external defibrillator

AEDs are safe and effective when used by laypeople, including if they have had minimal or no training.⁵⁸ AEDs may make it possible to defibrillate many minutes before professional help arrives. CPR providers should continue CPR with minimal interruption to chest compressions both while attaching an AED and during its use. CPR providers should concentrate on following the voice prompts, particularly when instructed to resume CPR, and minimising interruptions in chest compression.

Public access defibrillation (PAD) programmes

Public access AED programmes should be actively implemented in public places with a high density and movement of people such as airports, railway stations, bus terminals, sport facilities, shopping malls, stadiums, centres, offices, and casinos – where cardiac arrests are frequently witnessed and trained CPR providers can quickly be on scene.^{15,59-62} AEDs should also be provided in remote locations where an emergency ambulance response would be likely to be delayed (e.g. aircraft)

Risks to recipients of CPR

It is extremely rare for bystander CPR to cause serious harm in victims who are eventually found not to be in cardiac arrest. Those who are in cardiac arrest and exposed to longer durations of CPR are likely to sustain rib and sternal fractures. Damage to internal organs can occur but is rare.⁶⁵ The balance of benefits from bystander CPR far outweighs the risks. CPR providers should not, therefore, be reluctant to start CPR because of the concern of causing harm.

Risks to the CPR provider

CPR training and actual performance is safe in most circumstances. Although rare occurrences of muscle strain, back symptoms, shortness of breath, hyperventilation, pneumothorax, chest pain, myocardial infarction and nerve injury have been described in rescuers, the incidence of these events is extremely low. Individuals undertaking CPR training should be advised of the nature and extent of the physical activity required during the training programme. Learners and CPR providers who develop significant symptoms (e.g. chest pain or severe shortness of breath) during CPR training should be advised to stop and seek medical attention.

Although injury to the CPR provider from a defibrillator shock is extremely rare, standard surgical or clinical gloves do not provide adequate electrical protection. CPR providers, therefore, should not continue manual chest compressions during shock delivery. Avoid direct contact between the CPR provider and the victim when defibrillation is performed.

Adverse psychological effects after performing CPR are relatively rare. If symptoms do occur the CPR provider should consult their general practitioner.

Choking

Choking is an uncommon but potentially treatable cause of accidental death. As most choking events are associated with eating, they are commonly witnessed. As victims are initially conscious and responsive, early interventions can be life-saving.

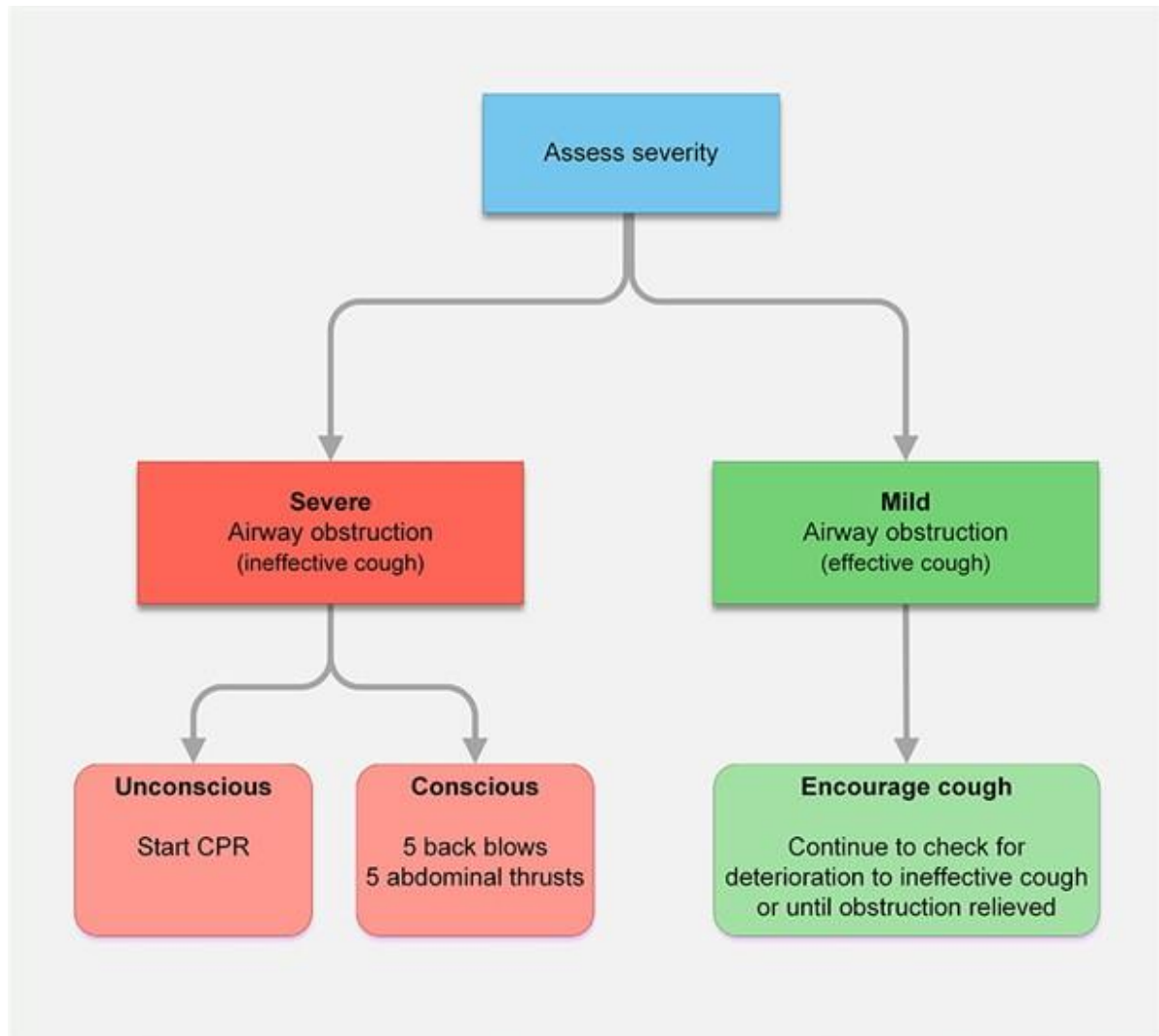
Recognition

Recognition of airway obstruction is the key to successful outcome, so do not confuse this emergency with fainting, myocardial infarction, seizure or other conditions that may cause sudden respiratory distress, cyanosis or loss of consciousness. Choking usually occurs while the victim is eating or drinking. People at increased risk of choking include those with reduced consciousness, drug and/or alcohol intoxication, neurological impairment with reduced swallowing and cough reflexes (e.g. stroke, Parkinson's disease), respiratory disease, mental impairment, dementia, poor dentition and older age.⁶⁶

Table 2 and Figure 3 present the treatment for the adult with choking. Foreign bodies may cause either mild or severe airway obstruction. It is important to ask the conscious victim "Are you choking?" The victim that is able to speak, cough and breathe has mild obstruction. The victim that is unable to speak, has a weakening cough, is struggling or unable to breathe, has severe airway obstruction.

Table 2: Sequence of steps for managing the adult victim who is choking

SEQUENCE	Technical description
SUSPECT CHOKING	Be alert to choking particularly if victim is eating
ENCOURAGE TO COUGH	Instruct victim to cough
GIVE BACK BLOWS	If cough becomes ineffective give up to 5 back blows <ul style="list-style-type: none"> • Stand to the side and slightly behind the victim • Support the chest with one hand and lean the victim well forwards so that when the obstructing object is dislodged it comes out of the mouth rather than goes further down the airway • Give five sharp blows between the shoulder blades with the heel of your other hand
GIVE ABDOMINAL THRUSTS	If back blows are ineffective give up to 5 abdominal thrusts <ul style="list-style-type: none"> • Stand behind the victim and put both arms round the upper part of the abdomen • Lean the victim forwards • Clench your fist and place it between the umbilicus (navel) and the ribcage • Grasp this hand with your other hand and pull sharply inwards and upwards • Repeat up to five times • If the obstruction is still not relieved, continue alternating five back blows with five abdominal thrusts
START CPR	Start CPR if the victim becomes unresponsive <ul style="list-style-type: none"> • Support the victim carefully to the ground • Immediately activate the ambulance service • Begin CPR with chest compressions



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