

Introduction

This chapter contains the guidelines for out-of-hospital, single rescuer, adult basic life support (BLS). Like the other guidelines in this publication, it is based on the document *2010 International Consensus on Cardiopulmonary Resuscitation and Emergency Cardiovascular Care Science with Treatment Recommendations (CoSTR)*, which was published in October 2010. Basic life support refers to maintaining airway patency and supporting breathing and the circulation without the use of equipment other than a protective device.

It is important that those who may be present at the scene of a cardiac arrest, particularly lay bystanders, should have learnt the appropriate resuscitation skills and be able to put them into practice. Simplification of the BLS sequence continues to be a feature of these guidelines, but, in addition, there is now advice on who should be taught what skills, particularly chest-compression-only or chest compression and ventilation. Within this advice, allowance has been made for the rescuer who is unable or unwilling to perform rescue breathing, and for those who are untrained and receive telephone advice from the ambulance service.

Guidelines 2000 introduced the concept of checking for 'signs of a circulation'. This change was made because of the evidence that relying on a check of the carotid pulse to diagnose cardiac arrest is unreliable and time-consuming, mainly, but not exclusively, when attempted by non-healthcare professionals.⁹ Subsequent studies have shown that checking for breathing is also prone to error, particularly as agonal gasps are often misdiagnosed as normal breathing.¹⁰ In Guidelines 2010 the absence of normal breathing continues to be the main sign of cardiac arrest in a non-responsive victim. Once cardiopulmonary resuscitation (CPR) has started, it is now recommended that the rescuer should only stop CPR if the victim shows signs of regaining consciousness, such as coughing, opening his eyes, speaking, or moving purposefully, as well as breathing normally.

Guideline changes

It is well documented that interruptions in chest compression are common^{11, 12} and are associated with a reduced chance of survival.¹³ The 'perfect' solution is to deliver continuous compressions whilst giving ventilations independently. This is possible when the victim has an advanced airway in place, and is discussed in the adult advanced life support (ALS) chapter. Compression-only CPR is another way to increase the number of compressions given and will, by definition, eliminate pauses. It is effective for a

limited period only (probably less than 5 min)¹⁴ and is not recommended as the standard management of out-of-hospital cardiac arrest.

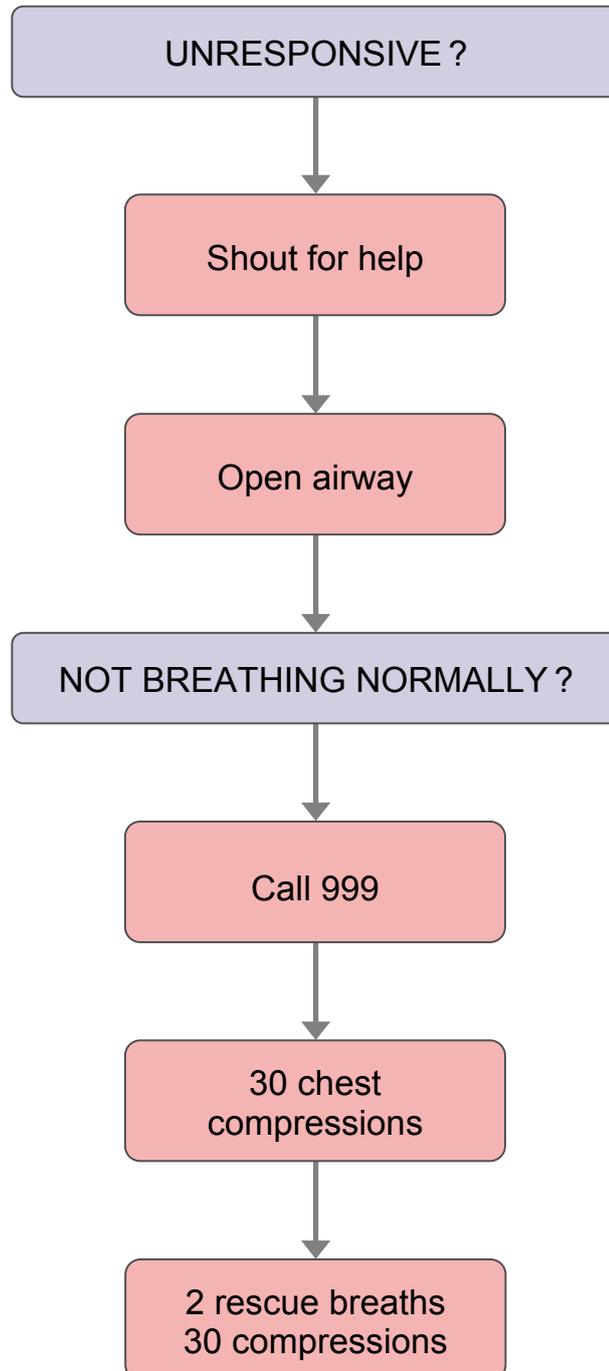
It is also known that chest compressions, both in hospital and outside, are often undertaken with insufficient depth and at the wrong rate.^{12, 15}

The following changes in the BLS guidelines have been made to reflect the importance placed on chest compression, particularly good quality compressions, and to attempt to reduce the number and duration of pauses in chest compression:

1. When obtaining help, ask for an automated external defibrillator (AED), if one is available.
2. Compress the chest to a depth of 5-6 cm and at a rate of 100-120 min⁻¹.
3. Give each rescue breath over 1 s rather than 2 s.
4. Do not stop to check the victim or discontinue CPR unless the victim starts to show signs of regaining consciousness, such as coughing, opening his eyes, speaking, or moving purposefully AND starts to breathe normally.
5. Teach CPR to laypeople with an emphasis on chest compression, but include ventilation as the standard, particularly for those with a duty of care.

In addition, advice has been added on the use of oxygen, and how to manage a victim who regurgitates stomach contents during resuscitation.

Adult basic life support algorithm



Adult basic life support sequence

Basic life support consists of the following sequence of actions:

1. **Make sure the victim, any bystanders, and you are safe.**
2. **Check the victim for a response.**
 - Gently shake his shoulders and ask loudly, 'Are you all right?'
- 3A. **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.
- 3B. **If he does not respond:**
 - Shout for help.
 - Turn the victim onto his back and then open the airway using head tilt and chin lift:
 - 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.
4. **Keeping the airway open, look, listen, and feel for normal breathing.**
 - Look for chest movement.
 - Listen at the victim's mouth for breath sounds.
 - Feel for air on your cheek.

In the first few minutes after cardiac arrest, a victim may be barely breathing, or taking infrequent, noisy, gasps. This is often termed agonal breathing and must not be confused with normal breathing.

Look, listen, and feel for **no more** than **10 s** to determine if the victim is breathing normally. If you have any doubt whether breathing is normal, act as if it is **not** normal.

- 5A. **If he is breathing normally:**
 - Turn him into the recovery position (**see below**).
 - Summon help from the ambulance service by mobile phone. If this is not possible, send a bystander. Leave the victim only if no other way of obtaining help is possible.
 - Continue to assess that breathing remains normal. If there is any doubt about the presence of normal breathing, start CPR (5B).

5B. If he is not breathing normally:

- Ask someone to call for an ambulance and bring an AED if available. If you are on your own, use your mobile phone to call for an ambulance. Leave the victim only when no other option exists for getting help.
- Start chest compression as follows:
 - 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 sternum (breastbone)).
 - 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. Do not apply any pressure over the upper abdomen or the bottom end of the sternum.
 - Position yourself vertically above the victim's chest and, with your arms straight, press down on the sternum 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.
 - Compression and release should take an equal amount of time.

6A. Combine chest compression with rescue breaths:

- After 30 compressions open the airway again using head tilt and chin lift.
- Pinch the soft part of the victim's nose closed, using the index finger and thumb of your hand on his forehead.
- Allow his 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 his mouth whilst watching for his chest to rise; take about one second to make his chest rise 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 his chest to fall as air comes out.
- Take another normal breath and blow into the victim's mouth once more to give a total of two effective rescue breaths. The two breaths should not take more than 5 s. Then return your hands without delay to the correct position on the sternum and give a further 30 chest compressions.
- Continue with chest compressions and rescue breaths in a ratio of 30:2.
- Stop to recheck the victim only if he starts to show signs of regaining consciousness, such as coughing, opening his eyes, speaking, or moving purposefully AND starts to breathe normally; otherwise **do not interrupt resuscitation**.

If the initial rescue breath of each sequence does not make the chest rise as in normal breathing, then, before your next attempt:

- Check the victim's mouth and remove any visible obstruction.
- Recheck that there is adequate head tilt and chin lift.
- Do not attempt more than two breaths each time before returning to chest compressions.

If there is more than one rescuer present, another should take over CPR about every 1-2 min to prevent fatigue. Ensure the minimum of delay during the changeover of rescuers, and do not interrupt chest compressions.

6B. Compression-only CPR

- If you are not trained to, or are unwilling to give rescue breaths, give chest compressions only.
- If chest compressions only are given, these should be continuous at a rate of 100 - 120 min⁻¹.
- Stop to recheck the victim only if he starts to show signs of regaining consciousness, such as coughing, opening his eyes, speaking, or moving purposefully AND starts to breathe normally; otherwise **do not interrupt resuscitation**.

7. Continue resuscitation until:

- qualified help arrives and takes over,
- the victim starts to show signs of regaining consciousness, such as coughing, opening his eyes, speaking, or moving purposefully AND starts to breathe normally, OR
- you become exhausted.

Further points related to basic life support

Risks to the rescuer and victim

The safety of both the rescuer and victim are paramount during a resuscitation attempt. There have been few incidents of rescuers suffering adverse effects from undertaking CPR, with only isolated reports of infections such as tuberculosis (TB) and severe acute respiratory distress syndrome (SARS). Transmission of HIV during CPR has never been reported.¹⁶

There have been no human studies to address the effectiveness of barrier devices during CPR; however, laboratory studies have shown that certain filters, or barrier devices with one-way valves, prevent transmission of oral bacteria from the victim to the rescuer during mouth-to-mouth ventilation. Rescuers should take appropriate safety precautions where feasible, especially if the victim is known to have a serious infection

such as TB or SARS. During an outbreak of a highly infectious condition (such as SARS), full protective precautions for the rescuer are essential.

Initial rescue breaths

During the first few minutes after non-asphyxial cardiac arrest the blood oxygen content remains high. Therefore, ventilation is less important than chest compression at this time.

It is well recognised that skill acquisition and retention are aided by simplification of the BLS sequence of actions. It is also recognised that rescuers are frequently unwilling to carry out mouth-to-mouth ventilation for a variety of reasons, including fear of infection and distaste for the procedure. For these reasons, and to emphasise the priority of chest compressions, it is recommended that, in adults, CPR should start with chest compressions rather than initial ventilations.

Jaw thrust

The jaw thrust technique is not recommended for lay rescuers because it is difficult to learn and perform. Therefore, the lay rescuer should open the airway using a head-tilt-chin-lift manoeuvre for both injured and non-injured victims.

Agonal gasps

Agonal gasps are present in up to 40% of cardiac arrest victims.¹⁰ Therefore laypeople should be taught to begin CPR if the victim is unconscious (unresponsive) and not breathing normally. It should be emphasised during training that agonal gasps occur commonly in the first few minutes after sudden cardiac arrest; they are an indication for starting CPR immediately and should not be confused with normal breathing.

Use of oxygen during basic life support

There is no evidence that oxygen administration is of benefit during basic life support in the majority of cases of cardiac arrest before healthcare professionals are available with equipment to secure the airway. Its use may lead to interruption in chest compressions, and is not recommended, except in cases of drowning (see below).

Mouth-to-nose ventilation

Mouth-to-nose ventilation is an effective alternative to mouth-to-mouth ventilation. It may be considered if the victim's mouth is seriously injured or cannot be opened, if the rescuer is assisting a victim in the water, or if a mouth-to-mouth seal is difficult to achieve.

Mouth-to-tracheostomy ventilation

Mouth-to-tracheostomy ventilation may be used for a victim with a tracheostomy tube or tracheal stoma who requires rescue breathing.

Bag-mask ventilation

Considerable practice and skill are required to use a bag and mask for ventilation. The lone rescuer has to be able to open the airway with a jaw thrust whilst simultaneously holding the mask to the victim's face. It is a technique that is appropriate only for lay rescuers who work in highly specialised areas, such as where there is a risk of cyanide poisoning or exposure to other toxic agents. There are other specific circumstances in which non-healthcare providers receive extended training in first aid, which could include training, and retraining, in the use of bag-mask ventilation. The same strict training that applies to healthcare professionals should be followed and the two-person technique is preferable.

Chest compression

In most circumstances it will be possible to identify the correct hand position for chest compression without removing the victim's clothes. If in any doubt, remove outer clothing.

Each time compressions are resumed on an adult, the rescuer should place his hands on the lower half of the sternum. It is recommended that this location be taught in a simple way, such as 'place the heel of your hand in the centre of the chest with the other hand on top.' This teaching should be accompanied by a demonstration of placing the hands on the lower half of the sternum.¹⁷ Use of the inter nipple line as a landmark for hand placement is not reliable.

Performing chest compression:

- a. Compress the chest at a rate of 100-120 min⁻¹.
- b. Each time compressions are resumed, place your hands without delay 'in the centre of the chest' (see above).
- c. Pay attention to achieving the full compression depth of 5-6 cm (for an adult).
- d. Allow the chest to recoil completely after each compression.
- e. Take approximately the same amount of time for compression and relaxation.
- f. Minimise interruptions in chest compression.
- g. Do not rely on a palpable carotid or femoral pulse as a gauge of effective arterial flow.
- h. 'Compression rate' refers to the speed at which compressions are given, not the total number delivered in each minute. The number delivered is

determined not only by the rate, but also by the number of interruptions to open the airway, deliver rescue breaths, and allow AED analysis.

Compression-only CPR

Studies have shown that compression-only CPR may be as effective as combined ventilation and compression in the first few minutes after non-asphyxial arrest. However, chest compression combined with rescue breaths is the method of choice for CPR by trained lay rescuers and professionals and should be the basis for lay-rescuer education. Lay rescuers who are unable or unwilling to provide rescue breaths, should be encouraged to give chest compressions alone. When advising untrained laypeople by telephone, ambulance dispatchers should give instruction on compression-only CPR.^{18, 19, 19a}

Regurgitation during CPR

Regurgitation of stomach contents is common during CPR, particularly in victims of drowning. If regurgitation occurs:

- Turn the victim away from you.
- Keep him on his side and prevent him from toppling on to his front.
- Ensure that his head is turned towards the floor and his mouth is open and at the lowest point, thus allowing vomit to drain away.
- Clear any residual debris from his mouth with your fingers; and immediately turn him on to his back, re-establish an airway, and continue rescue breathing and chest compressions at the recommended rate.

Teaching CPR

Compression-only CPR has potential advantages over chest compression and ventilation, particularly when the rescuer is an untrained or partially-trained layperson. However, there are situations where combining chest compressions with ventilation is better, for example in children, asphyxial arrests, and prolonged arrests.^{20, 21} Therefore, CPR should remain standard care for healthcare professionals and the preferred target for laypeople, the emphasis always being on minimal interruption in compressions.

A simple, education-based approach is recommended:

- Ideally, full CPR skills should be taught to all citizens.
- Initial or limited-time training should always include chest compression.
- Subsequent training (which may follow immediately or at a later date) should include ventilation as well as chest compression.

CPR training for citizens should be promoted, but untrained lay people should be encouraged to give chest compressions only, when possible and appropriate with telephone advice from an ambulance dispatcher.

Those laypeople with a duty of care, such as first aid workers, lifeguards, and child minders, should be taught chest compression and ventilation.

Over-the-head CPR

Over-the-head CPR for a single rescuer and straddle CPR for two rescuers may be considered for resuscitation in confined spaces.

Recovery position

There are several variations of the recovery position, each with its own advantages. No single position is perfect for all victims. The position should be stable, near a true lateral position with the head dependent, and with no pressure on the chest to impair breathing.

The RC(UK) recommends the following sequence of actions to place a victim in the recovery position:

- Remove the victim's glasses, if present.
- 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.

If the victim has to be kept in the recovery position for **more than 30 min** turn him to the opposite side to relieve the pressure on the lower arm.

Choking

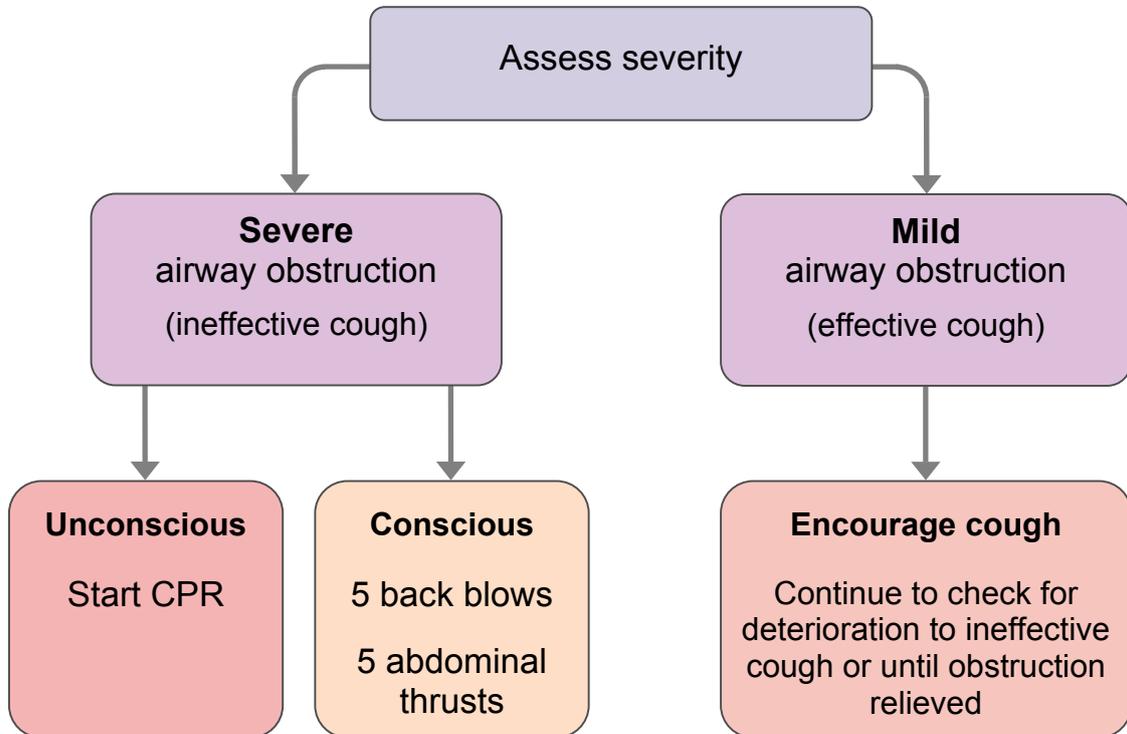
Recognition

Because recognition of choking (airway obstruction by a foreign body) is the key to successful outcome, it is important not to confuse this emergency with fainting, heart attack, seizure, or other conditions that may cause sudden respiratory distress, cyanosis, or loss of consciousness.

Foreign bodies may cause either mild or severe airway obstruction. The signs and symptoms enabling differentiation between mild and severe airway obstruction are summarised in the table below. It is important to ask the conscious victim 'Are you choking?'

General signs of choking	
<ul style="list-style-type: none"> • Attack occurs while eating • Victim may clutch his neck 	
Signs of severe airway obstruction	Signs of mild airway obstruction
<p><i>Response to question 'Are you choking?'</i></p> <ul style="list-style-type: none"> • Victim unable to speak • Victim may respond by nodding <p><i>Other signs</i></p> <ul style="list-style-type: none"> • Victim unable to breathe • Breathing sounds wheezy • Attempts at coughing are silent • Victim may be unconscious 	<p><i>Response to question 'Are you choking?'</i></p> <ul style="list-style-type: none"> • Victim speaks and answers yes <p><i>Other signs</i></p> <ul style="list-style-type: none"> • Victim is able to speak, cough, and breathe

Adult choking treatment algorithm



Sequence for the treatment of adult choking

(This sequence is also suitable for use in children over the age of 1 year)

1. **If the victim shows signs of mild airway obstruction:**
 - Encourage him to continue coughing, but do nothing else.
2. **If the victim shows signs of severe airway obstruction and is conscious:**
 - Give up to five back blows.
 - 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 **up to** five sharp blows between the shoulder blades with the heel of your other hand.

- Check to see if each back blow has relieved the airway obstruction. The aim is to relieve the obstruction with each blow rather than necessarily to give all five.
- If five back blows fail to relieve the airway obstruction give up to five abdominal thrusts.
 - Stand behind the victim and put both arms round the upper part of his abdomen.
 - Lean the victim forwards.
 - Clench your fist and place it between the umbilicus (navel) and the bottom end of the sternum (breastbone).
 - 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.

3. If the victim becomes unconscious:

- Support the victim carefully to the ground.
- Call an ambulance immediately.
- Begin CPR (from 5B of the adult BLS sequence). Healthcare providers, trained and experienced in feeling for a carotid pulse, should initiate chest compressions even if a pulse is present in the unconscious choking victim.

Following successful treatment for choking, foreign material may nevertheless remain in the upper or lower respiratory tract and cause complications later. Victims with a persistent cough, difficulty swallowing, or with the sensation of an object being still stuck in the throat should therefore be referred for an immediate medical opinion.

Resuscitation of children and victims of drowning

Both ventilation and compression are important for victims of cardiac arrest when the oxygen stores become depleted: about 2 - 4 min after collapse from ventricular fibrillation (VF), and immediately after collapse for victims of asphyxial arrest. Previous guidelines tried to take into account the difference in causation, and recommended that victims of identifiable asphyxia (drowning; trauma; intoxication) and children should receive 1 min of CPR before the lone rescuer left the victim to get help. But most cases of sudden cardiac arrest out of hospital occur in adults and are of cardiac origin due to VF (even though many of these will have changed to a non-shockable rhythm by the time of the first rhythm analysis). These additional recommendations, therefore, added to the complexity of the guidelines whilst applying to only a minority of victims.

Many children do not receive resuscitation because potential rescuers fear causing harm. This fear is unfounded; it is far better to use the adult BLS sequence for resuscitation of a child than to do nothing. For ease of teaching and retention, laypeople

should be taught to use the adult sequence for children who are not responsive and not breathing normally, with the single modification that the chest should be compressed by one third of its depth. However, the following minor modifications to the adult sequence will make it even more suitable for use in children:

- Give 5 initial rescue breaths before starting chest compressions (adult BLS sequence of actions 5B).
- If you are on your own, perform CPR for 1 min before going for help.
- Compress the chest by one third of its depth. Use two fingers for an infant under 1 year; use one or two hands for a child over 1 year as needed to achieve an adequate depth of compression.

The same modifications of five initial breaths, and 1 min of CPR by the lone rescuer before getting help, may improve outcome for victims of drowning. This modification should be taught only to those who have a specific duty of care to potential drowning victims (e.g. lifeguards). If supplemental oxygen is available, and can be brought to the victim and used without interruption in CPR (e.g., by attaching to a resuscitation face mask), it may be of benefit.

Drowning is easily identified. It can be difficult, on the other hand, for a layperson to recognise when trauma or intoxication has caused cardiorespiratory arrest. If either cause is suspected the victim should be managed according to the standard BLS protocol.