



# Improving survival: a practical CPR update

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## Key points

- Basic life support is now simplified and easier.
- Any attempt at cardiopulmonary resuscitation (CPR), including compression-only CPR, is better than none.
- Defibrillation (if available) is part of basic life support.
- Compression-only CPR has been shown to be effective.
- Initial rescue breaths are only essential for infants and children.

The earlier cardiopulmonary resuscitation is given, the better the outcome, and the earlier defibrillation is performed, the more lives saved. Fewer interruptions to the compressions and maintenance of quality of chest compression have also been shown to increase survival.

Cardiopulmonary resuscitation (CPR) – the aim of which is to provide cardiac output and ventilation while facilitating the return to spontaneous circulation – generally has a very poor outcome, especially in patients whose cardiac arrests were unwitnessed.<sup>1</sup> Lives can, however, be saved and any attempt at resuscitating a person who is unresponsive, unconscious, not moving or not appearing to be breathing is worthwhile. The earlier CPR is given, the better the outcome.<sup>2,3</sup>

Healthcare professionals and members of the general public are most likely to be confronted with a collapsed/arrested person who is well known to them, especially family or loved ones. To achieve best results, as many members of the community as possible should be comfortable with the prompt application of CPR and the use of automatic external defibrillators (AEDs), which are now available in many

public places. Additionally, the population served by GPs and other healthcare professionals is becoming older, more complex and more likely to need resuscitating.

GPs have a duty to respond to sudden cardiac arrest. They are expected to perform basic CPR procedures on a patient or member of the community in accordance with the current resuscitation guidelines of the Australian Resuscitation Council and without the assistance of specialist emergency services or equipment as and when needed.<sup>4</sup> Major changes have been made recently to the Council's basic life support guidelines.<sup>5</sup> Cardiopulmonary resuscitation (CPR) skills are used infrequently and, therefore, may diminish with time. To ensure skills and competency are maintained, completion of a basic CPR course that meets the Australian Resuscitation Council guidelines is a requirement of the

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## CARDIOPULMONARY RESUSCITATION (CPR)

### Fundamental principles

- The earlier CPR is given, the much better the outcome.
- Help should be sought as soon as possible.
- The earlier the defibrillation, the more lives saved.
- Any attempt at prompt CPR is hugely more successful than none at all (or delayed).
- Lack of an airway is still a major cause of preventable death.

### Increased survival

Survival of resuscitation patients is increased by:

- prompt initiation of chest compression
- fewer interruptions to chest compression
- fast and deep chest compressions
- not initially trying to find a pulse
- simplification of technique: use of compression to ventilation ratio of 30:2 for patients of all ages and for single and multiple responders, and the lower half of the sternum being the site of compression.

Royal Australian College of General Practitioners (RACGP) Quality Improvement and Continuing Professional Development (QI&CPD) Program for the 2011–2013 triennium.

This article reviews the basics of CPR, including the recent changes to the Australian Resuscitation Council's basic life support guidelines.

## DOES CPR WORK?

In the past, anecdotal and scientifically untested techniques existed for CPR. Now, despite obvious ethical and experimental design difficulties, major and substantiated improvements in techniques are giving better results in both return of

a patient's spontaneous circulation and the patient's neurological function on discharge from hospital.<sup>2,6</sup>

## WHAT ARE THE FUNDAMENTAL PRINCIPLES OF CPR?

CPR includes basic life support (BLS) and advanced life support (ALS). Defibrillation, if available, is an important part of BLS. BLS should be initiated early and should be supplemented by ALS as soon as possible. GPs and members of the general public generally hand over the patient to ambulance paramedics for ALS but this may not be possible in rural and remote areas.

To save lives, CPR should be started immediately on anyone who is unresponsive or unconscious or not breathing normally or not moving. Infants and children are most likely to have a respiratory cause for an arrest and thus initial rescue breaths (compression to ventilation ratio of 30:2) are essential for them. Adults are most likely to have a cardiac cause for an arrest and compression-only CPR has been shown to be effective.

Fundamental principles of CPR that have been shown to make a difference include the following:

- the earlier CPR is given (immediately to within minutes), the much better the outcome
- help should be sought as soon as possible – call the ambulance service on triple zero (000)
- the earlier the defibrillation, the more lives saved
- any attempt at prompt CPR, including compression-only CPR, is hugely more successful than none at all or delayed CPR
- lack of an airway (remedy with lateral positioning, chin lift, head tilt, jaw thrust) is still a major cause of preventable death.

Evidence is showing increased survival of resuscitation patients with:

- prompt initiation of chest compression

## POSSIBLE PREDICTORS OF AN ARREST<sup>7,8</sup>

- Respiratory rate: above 30 or below 5 breaths per minute
- Oxygen desaturation: O<sub>2</sub> saturation below 90%, measured by pulse oximetry
- Pulse: below 40 or above 140 beats per minute
- Blood pressure: below 90 mmHg
- Deteriorating consciousness: a fall in Glasgow Coma Scale score of 2 or more points

- fewer interruptions to chest compression
- good quality (faster, deeper) compressions
- not initially trying to find a pulse, which delays initiation of chest compression
- simplification of technique, including the use of a compression to ventilation ratio of 30:2 (i.e. 30 compressions followed by two ventilations) for patients of all ages and for single and multiple responders, and the site of compression being the lower half of the sternum
- early use of defibrillation.

The principles of CPR are summarised in the box on this page (above left).

## IS AN ARREST PREDICTABLE?

There is good evidence from the health-care setting (hospitals and nursing homes) that a worsening trend in vital signs occurs in patients before the actual cardiac arrest (see the box above).<sup>7,8</sup> These deteriorating vital signs often occur well before (hours) the arrest. Early identification and intervention in a deteriorating patient is an established strategy.

## RESUSCITATION

The initial steps of resuscitation for adults, children and infants (not neonates) – basic

life support – are shown in the box on this page.<sup>4,9</sup> Flowcharts showing the Australian Resuscitation Council's recommended procedures for basic and advanced life support and CPR are available on the Council's website: [www.resus.org.au](http://www.resus.org.au) (see the box listing resources on page 54).<sup>4</sup>

Changes made at the end of 2010 to the basic life support recommendations of the Council include the following:<sup>5</sup>

- focus on unresponsive (no or only minor response to verbal and tactile stimuli – 'talk and touch') and not breathing normally as the indicators for resuscitation
- new focus on maintenance of CPR quality, including changing of rescuers every two minutes
- new guideline recognising role of AEDs as part of BLS in both out-of-hospital and in-hospital environments
- addition of 'S' for 'Send for help' to the steps in resuscitation, which are now DRS ABCD
- in the victim who is unresponsive or not breathing normally, CPR commences with chest compressions rather than with rescue breaths
- if the rescuer is unwilling or unable to perform rescue breathing, compression-only CPR should be performed.

It should be noted, however, that because infants and children are most likely to have a respiratory cause for an arrest, initial rescue breaths should be performed in these patients if at all possible.

## THE PRACTICE

When attending a collapsed person, the core response should follow the procedure recommended for BLS – that is, DRS ABCD (see the box on this page).

Ideally rescuers who are GPs will have done a refresher course in CPR, partly as a requirement for continuing education and partly because they like to lead by

## STEPS IN RESUSCITATION<sup>3,5</sup>

### Provide DRS ABCD

#### D. DANGER

- Check for danger (hazards, risks) to ensure the safety of rescuers, victims and bystanders

#### R. RESPONSIVENESS

- Check for responsiveness of victim – unresponsiveness (no or only minor response to verbal and tactile stimuli – 'talk and touch') and not breathing normally are indicators for resuscitation in patients of any age

#### S. SEND FOR HELP

- Call for an ambulance (triple zero, 000)

#### A. AIRWAY

- Open airway by opening the mouth and using chin lift, head tilt or jaw thrust

#### B. BREATHING

- Check breathing – but no need to deliver two rescue breaths

#### C. CPR/COMPRESSIONS

- Commence CPR, starting with compressions rather than rescue breaths:
  - have victim on firm surface, place hand on the centre of the chest
  - compress chest at rate of 100 per minute
  - perform sequence of 30 compressions with two breaths (the breaths may be produced by mouth-to-mouth, mouth-to-mask or bag-valve-mask ventilation depending on training)
  - watch for rise in chest with each breath
- Perform compression-only CPR if unwilling/unable to perform rescue breathing
- If possible, change rescuers performing CPR every two minutes to maintain quality of CPR

#### D. DEFIBRILLATION

- Provide a defibrillation shock as soon as an AED defibrillator is available

Continue CPR until the patient recovers or until it can be clearly established that recovery is not possible. If complete airway obstruction by a foreign body is present, back blows or lateral chest thrust with the patient in the lateral position is recommended.

SOURCE: Adapted from reference 9; updated with November/December 2010 changes to the Australian Resuscitation Council guidelines for basic life support.<sup>5</sup>

ABBREVIATIONS: CPR = cardiopulmonary resuscitation, AED = automatic external defibrillator.

example and support the teaching of CPR to as many people as possible.

As with all crises, several things usually go wrong at once (Murphy's law: 'Anything that can go wrong, will go wrong') and several things need to happen more or less simultaneously.

## When to start CPR

GPs and other people are often unsure whether they should start CPR when faced with a collapsed person or are fearful of being seen to overreact in such a situation. In an arresting patient, even seconds count. The decision to start CPR

**DIAGNOSIS OF COLLAPSE/  
UNCONSCIOUSNESS<sup>10</sup>**

**A short, simple differential diagnosis of collapse/unconsciousness – mnemonic 'ESCAPE'**

**E**

Electrocution

**S**

Syncope

Seizure

Stroke

Sepsis (cerebral or systemic)

Sugar

**C**

Cardiac

Cold

Circulation (hypovolaemia)

**A**

Anoxia

Allergic

**P**

Poisons

Pills

Pulmonary embolism

**E**

Envenomations

Electrolytes

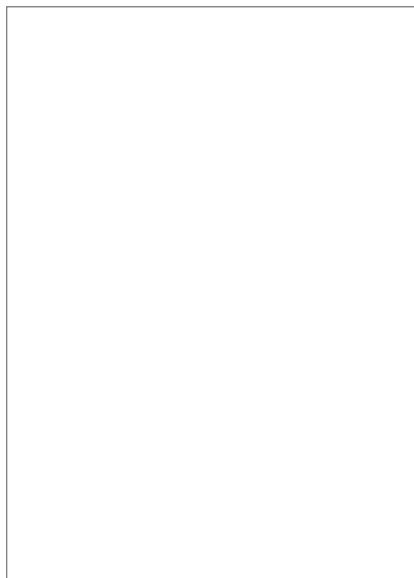
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is very straightforward: if a patient of any age becomes unresponsive or is not breathing normally, CPR must be started immediately.

There is really no choice whether to help a patient to survival, and CPR should not be delayed or withheld unless there are documented specific instructions to the contrary. Most resuscitated patients will need further medical attention.

Consideration should always be given to the causes of arrest/collapse/uncon-

sciousness, even during the 'arrest', so they can be promptly diagnosed and treated. The mnemonic 'ESCAPE' provides a prompt to the possible causes of collapse and unconsciousness, as listed in the box on this page (left).<sup>10</sup>

**SOME PRACTICAL ISSUES ARISING  
Defibrillators**

AEDs are becoming increasingly available in public places, their presence being clearly indicated by 'AED' signs on walls. As they are also becoming increasingly less expensive, the purchase of an AED may be considered when the risk to a patient is substantial (e.g. the elderly and those with diabetes or vascular disease) and an immediate triple zero emergency response is not available, such as on the farm or in the holiday house.

AEDs are simple and straightforward to use, and extremely effective, safe and reliable. They will only 'fire' on shockable rhythms. Instructions for their use are given in the box on this page (above right).

**Taking control: calling for help and organising the scene**

A prompt and ordered approach will give the best results in coping with a collapsed

**HOW TO USE AN AUTOMATIC  
EXTERNAL DEFIBRILLATOR  
(AED)****1. Apply the two adhesive pads to the patient**

Follow the clear diagram showing the sites: right parasternal over second intercostal space; left midaxillary line over sixth intercostal space (i.e. the current is to traverse the heart).

**2. Press the green 'on' button**

Stop chest compression so that the AED can analyse the patient's heart rhythm.

**3. Follow the 'voice' instructions**

- Ensure no one is in contact with the patient and that the area is safe (e.g. not wet).
- Ensure oxygen (if available) is held away from the patient.
- Press the red 'shock' button when directed.

**4. Immediately re-start chest compressions, unless clear signs of life are present**

person. Usually an attending GP will need to be the rescuer, take charge and ensure things go to plan. It is amazing how, in a serious crisis, people help and co-operate with the person who takes on the role of leadership.

Ideally the person most skilled in CPR should commence it immediately. Hopefully a mobile phone with reception or a landline will be available so that a triple zero (000) call can be made by another person. If there is only one rescuer present, he or she should start CPR and shout for help.

As the triple zero service is shared between ambulance, fire and police services, the caller has to specify the ambulance service when asked. The caller needs to inform the operator of the following,

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in a succinct and distinct manner:

- the nature of the emergency –the use of key words such as cardiac arrest, unconscious, breathing difficulty and bleeding help stress the urgency
- his or her name, and whether a doctor is in attendance
- the precise address the ambulance should come to, including the cross street and where the accessible entrance is.

If possible, someone should meet the ambulance on the street.

In order to have CPR performed, the patient will need to be in a safe place, positioned on his or her back on a flat, hard surface (usually the floor) with space to kneel next to him or her. A crowd scene should be avoided.

A couple of CPR helpers should be selected and the rescuer performing the CPR should be changed every two minutes or so to maintain the quality of the compressions. Another person should be delegated to give the people performing the CPR, the patient and the family a professional environment, including space, privacy, opportunity for communication and support for the family.

Once the ambulance arrives, the ambulance officers should be allowed to take over the care of the patient. Not even most critical care specialists (emergency and intensive care specialists, anaesthetists) can function in the hostile, out-of-hospital environment as well as specifically trained and equipped ambulance paramedics. There should, of course, be a two-way professional exchange of information, with the mutual aim of rapid treatment and patient transport to definitive care.

## **ADVANCED LIFE SUPPORT**

ALS is BLS with the addition of invasive techniques such as manual defibrillation, advanced airway management, intravenous access and drug therapy.<sup>4,11</sup> The appropriate equipment, drugs, knowledge and training are absolute requirements to providing ALS to a patient, and are found in hospital or other medical settings and in ambulances.

Cardiac rhythm assessment using an AED will determine if patients have a shockable or nonshockable rhythm. Those with a shockable rhythm (ventricular fibrillation [VF] or pulseless ventricular tachycardia [VT]) are likely to benefit from a defibrillator shock (using a lower energy level for infants and children), CPR being resumed immediately after delivery of the shock. A precordial thump may be considered in certain patients with witnessed cardiac arrest and pulseless VT if a defibrillator is not immediately available (it is relatively ineffective for VF). If spontaneous circulation does not return after several attempts at defibrillation, drug therapy (vasopressor [adrenaline] and antiarrhythmic [amiodarone]) should be considered.

In patients with nonshockable cardiac rhythms, adrenaline should be administered and other drugs considered, depending on the circumstances.

## USEFUL RESOURCES

The Australian Resuscitation Council provides various flowcharts free of charge on its website. These include the following:

- **Basic life support flowchart (titled 'Basic life support')**  
www.resus.org.au/public/arc\_basic\_life\_support.pdf
- **Adult cardiorespiratory arrest flowchart (titled 'Advanced life support for adults')**  
www.resus.org.au/public/arc\_adult\_cardiorespiratory\_arrest.pdf
- **Paediatric cardiorespiratory arrest flowchart (titled 'Advanced life support for infants and children')**  
www.resus.org.au/public/arc\_paediatric\_cardiorespiratory\_arrest.pdf
- **Resuscitation flowchart (titled 'Newborn life support')**  
www.resus.org.au/public/arc\_neonatal\_flowchart.pdf

Reversible causes of cardiac arrest should be considered and urgently managed. These include hypoxia, hypovolaemia, hypo/hyperthermia, hypo/hyperkalaemia, hypo/hyperglycaemia, tension pneumothorax, tamponade, toxins and thrombosis (pulmonary or cardiac).

Further details on ALS, including flowcharts for ALS in adults and in infants and children, can be found on the Australian Resuscitation Council's website (see the box on this page).<sup>4</sup>

## CONCLUSION

The life of a patient who is unresponsive, unconscious, not breathing normally or not moving may be saved by immediate defibrillation and CPR (i.e. basic life support). Uninterrupted good quality (deep and fast) chest compression saves more lives with better neurological

outcomes than interrupted and poor quality chest compression.<sup>6</sup>

Accumulating evidence on the survival of resuscitation patients has resulted in recent changes (end of 2010) to the Australian Resuscitation Council's basic life support guidelines, enabling basic life support to have improved outcomes and be more easily applied and taught. To achieve best results, health professionals need to ensure as many community members as possible are comfortable with the use of the increasingly available AEDs and the prompt application of CPR.

Everybody should be reminded that the life they save by CPR will most likely be that of a loved one, usually one of their own family. **MT**

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COMPETING INTERESTS: None.

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