Topic Overview: Cardiac Module
Sub-Module: C4 – Basic Life Support and Advanced Life Support
Last Updated August 3 2012

This handout is prepared as pre-reading for the EdWISE simulation session C4 – Basic Life Support (BLS) and Advanced Life Support (ALS). This session involves a presentation followed by a team based pause-and-discuss simulation scenario. Use this document to revise the topic or support your reflection on the session. Materials and instruction for this topic adhere to Australian Resuscitation Council (ARC) guidelines for BLS and ALS.

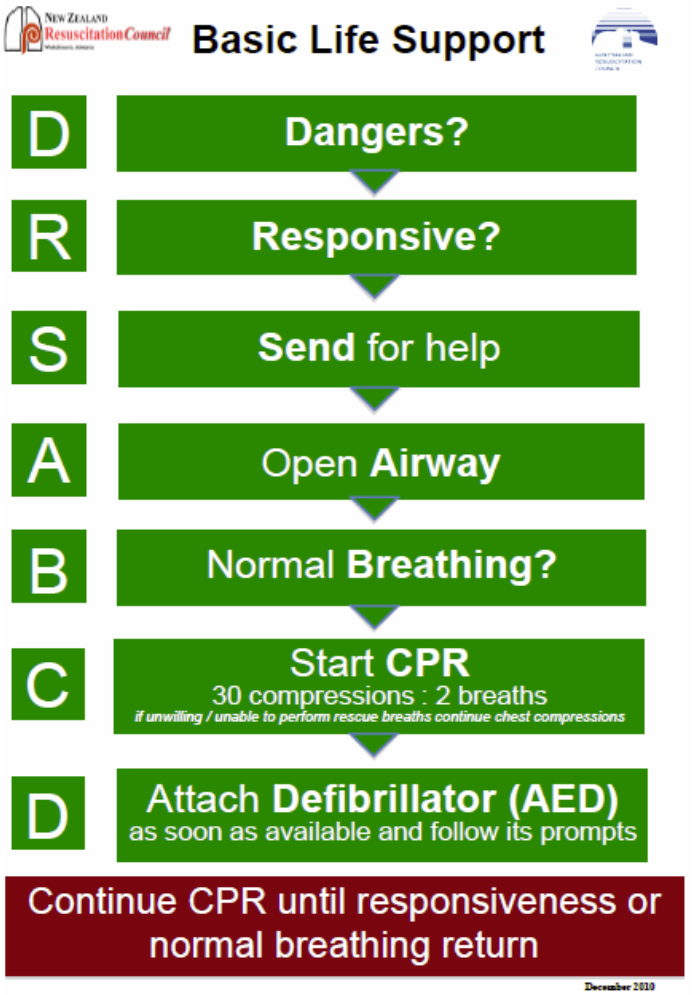
Session Objectives

1. Recognise cardiac arrest
2. Send for help
3. Apply the ARC BLS algorithm early in cardiac arrest
4. Progress to the ARC ALS algorithm ASAP
5. Use a Defibrillator safely and correctly in ALS (pulseless VT/VF athway)
6. Be familiar with drugs used in ALS

BASIC LIFE SUPPORT

Recognise Cardiac Arrest, Send for Help and commence cardiac compressions (CPR)

These objectives are the entry point to management of the arrested patient. The key steps are summarized in the ARC BLS flowchart as shown.



Your first encounter with the collapsed patient will be as the first person to notice the patient has collapsed or as a responder to a call for help from another person (layperson or colleague). It is easy to overlook key clinical features of arrest and/or fail to act. Stay focussed - methodically go through the steps DRSABCD in sequence (and

then repeat in a loop). **Note the recent emphasis on early and uninterrupted cardiac compressions means that in practice "C" immediately follows "S" preceding "A" and "B".**

Danger

First pay attention to the safety of yourself, other rescuers, and the patient. Eliminate danger (electrical hazards, fires, disruptive or threatening people), or move the patient and staff to a place of safety. Wear PPE (personal protective equipment).

Response

Two clinical signs are used to confirm cardiac arrest and the need to start BLS:
(i) The patient is not responsive (to "shout and shake"), and
(ii) The patient is not breathing *normally* noting agonal gasps are considered abnormal (ARC guideline 11.1.1)
The indicator 'signs of life' has been removed and does not feature in the recent December 2012 guidelines as this criterion was felt to be too subjective. The pulse check has also been de-emphasised as it was felt that rescuers often spend too long feeling for a pulse and are sometimes unreliable in ascertaining if a pulse is present.

Send for Help

Ensure someone gives the directions: "Call a Cardiac Arrest Call"; "Get the Defibrillator" and "Get senior help" and check these are acted upon.

Airway

1. Quickly make the assessment *"Is the airway patent?"* Use the conventional approach "Look Listen and Feel for expired air" to make this assessment. Normal breathing may be masked by functional airway obstruction in some unconscious patients who are not in cardiac arrest and 'normal' breathing will be revealed when the airway is made patent as you complete the following steps;
1. remove foreign bodies such as food boluses or dentures
2. use the 3 Step airway opening manouevre: chin lift, jaw thrust and head tilt
3. reassess

However if the patient is unresponsive (and making no attempt to breathe) the patient will require assisted ventilation with a manual bag/mask resuscitation bag.

Breathing

If the patient is not breathing with a normal pattern then you should:

1. **Start cardiac compressions -** We start with compressions (not rescue breaths), after we have assessed the airway and breathing and if we have found the patient to be unresponsive and not breathing normally. This is explained under "C".
2. **Support ventilation –** by one of the following techniques
    a. Provide manual ventilation using a self inflating manual resuscitation bag connected to O2 at high flow (10L/min). The duration of inspiration should be approximately 1 second and the frequency is 30 (compressions):2 (inflations). Ensure you maintain a patent airway evidenced by the chest rising and falling with each inspiration/expiration.
    b. If you are unfamiliar with this technique then perform "Mouth to Mask" ventilation.

If for some reason you are unable to perform rescue breaths the perform "Compression-only CPR". Compression-only CPR is not such an issue in hospital, as self-inflating (Laerdel, Ambubag) bags are available in the wards on arrest trolleys. This bypasses the need to deliver mouth-to-mouth, expired air resuscitation to patients. However, on the street or in the community, some rescuers feel uncomfortable or unable to deliver rescue breaths to a stranger they have found collapsed. The new guidelines make provision for this, given
(i)the increased emphasis of compressions over ventilation, and
(ii)the thinking that some attempt at resuscitation is better than no attempt at all.

Circulation – Cardiac Compressions (CPR)

Several key messages:

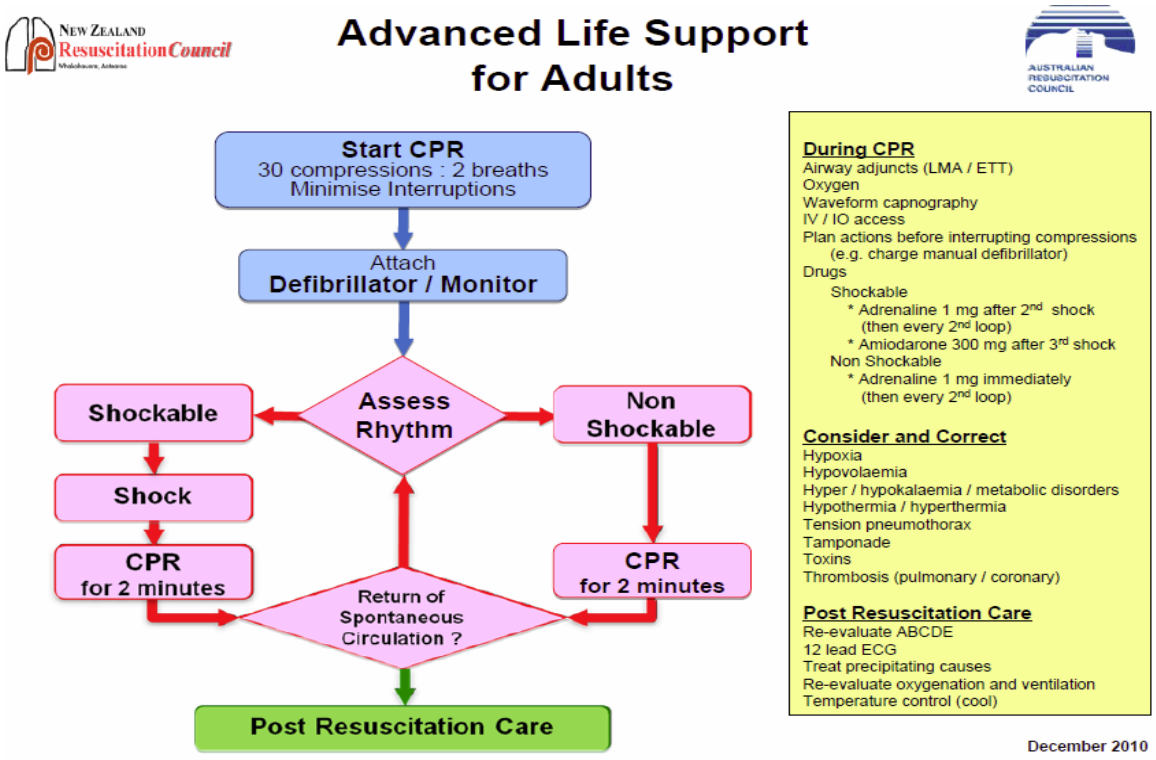
1. Allow equal time for compression and relaxation and allow complete chest recoil post compression
2. For CPR we need to "go hard, go fast" at a rate of 100/min (roughly to the beat of 'stay alive, stay alive'), with our elbows straight and our shoulders directly above the person's lower half of sternum. Effective external cardiac compression provides 20-30% of pre-arrest cardiac output.
3. It doesn't matter if you have one or more than one rescuer: the ratio of compressions to breaths remains the same for adult patients.

Summary:

- Ratio 30:2
- Compressions at a rate of 100/min
- 1/3 AP chest diameter
- "Go hard, go fast"

ADVANCED LIFE SUPPORT

The ARC ALS algorithm is shown below, the essential components focusing on defibrillation and drugs in addition to BLS



Defibrillation

Evidence suggests the likelihood of successful defibrillation decreases with time for shockable rhythms. "For every minute defibrillation is delayed, there is approximately a 10% reduction in survival if the victim is in cardiac arrest due to VF" (ARC Guideline 7). How would you know if it's a shockable rhythm?

- Automated external defibrillators (AEDs), self analyse and deliver a shock if required, once the pads are applied.
- Semi automatic defibrillators analyse and advise but require the operator to manually deliver the shock. Many hospital defibrillators are semi-automated but this varies so it is important to familiarise yourself with the unit locally available.
- Manual defibrillators require the operator to analyse the rhythm.

- Precordial thump: The indications have reduced the indications to a single criterion: monitored pulseless VT with a defibrillator not immediately available. The new guidelines no longer include VF as it is felt to be

"relatively ineffective for this rhythm" (ARC Guideline 11.3). It is delivered as a single sharp blow to the midsternum, and should *not* be delivered for unwitnessed cardiac arrest, or in patients with a recent sternotomy or chest trauma (ARC Guideline 11.3)

- Adhesive pads: Ensure you are *at* a minimum distance of 8cm away from any implanted pacemaker devices. Also do not apply the pads (or paddles) over medication patches as these may heat up and burn the patient's skin. Remove the patch if it is in a location you require, and wipe the area prior to attaching the pad. The patch may otherwise also "block the delivery of energy from the electrode pad to the heart" (ARC Guideline 7).
- Charge: We charge towards end of *the* 2min CPR to minimise the time without compressions. This is safe if we are using adhesive pads via a manual defibrillator (ARC Guideline 11.4). The default charge for biphasic defibrillators is either 150J or 200J.
- Asynchronous mode: Some defibrillators have a 'sync' button. However this is not to be activated in VF or pulseless VT. We are aiming to deliver an *unsynchronised* shock.
- Safety: It is an important responsibility of the person pressing the 'charge' button that they check everyone has stood clear prior to delivering the shock. We must also avoid having oxygen at high flows across the patient's chest if delivering the shock using paddles; and avoid charging the paddles unless they are placed on the patient's chest.

We need to resume CPR for a further 2 min post defibrillation as there is likely to be a period of myocardial stunning post arrest. It is therefore unlikely for the heart to immediately resume delivering an adequate perfusing pressure, even if sinus rhythm is restored. We are also unlikely to cause the patient harm by performing CPR during this interval: if the patient is perfusing their brain adequately, they will no doubt indicate this to you!
It is important to be mindful to minimise time away from chest compressions. Studies have shown that common errors include excessive interruptions to external cardiac compressions (ARC guideline 11.1.1). This time can therefore also be utilised (while one person checks the rhythm), for the person administering CPR to change over.

Whilst 2 min (1 loop) of CPR is being performed and the record-keeper is also keeping track of time, it is worthwhile for the team leader (and any available team members) to think about possible reversible causes. These are known as the 4H's and 4T's.

H's	T's
Hypoxia	Toxins
Hypovolaemia	Thrombus
Hyper / hypothermia	Tamponade
Hyper / hypokalaemia, metabolic disorders	Tension pnumothorax

Drugs in ALS

Shockable

Adrenaline 1mg after 2nd shock (then every 2nd cycle)
Amiodarone 300mg after 3rd shock

Non-shockable

Adrenaline 1mg immediately (then every 2nd cycle)
At the time of recommencement of CPR.

What evidence is there for the drugs we use? There is no evidence that either adrenaline or amiodarone increases the rate of survival to hospital discharge. However: Adrenaline increases the return of spontaneous circulation

and Amiodarone can improve the short-term outcome of survival to hospital *admission* in shock-refractory VF (vs placebo and lignocaine)
(Guideline 11.2)

Drug	Indication
Calcium	Hypocalcaemia, hyperkalaemia, CCB OD
Lignocaine	Substitute if amiodarone contraindicated
Magnesium	Torsade de pointes, dig toxicity, hypokalaemia, hypomagnesaemia
Potassium	Hypokalaemia
Sodium bicarbonate	TCA overdose, metabolic acidosis, >15min arrest, hyperkalaemia
Vasopressin	Alternative to adrenaline (insufficient evidence)
Thrombolytics	In adult cardiac arrest patients with proven or suspected pulmonary embolism

Advanced Airway Placement

- It is ideal to give 100% O2 via a secured airway (endotracheal tube) if possible. However, it is also ideal for intubation to "not interrupt cardiac compressions at all" (ARC guideline 11.1.1), or for "less than 20 seconds" (ARC Guideline 11.2). There is no proscribed time to intubate, or insert an Laryngeal Mask Airway – it depends on the skill set of the rescuers.
- **(Once you have secured the airway with an endotracheal tube, it is still important to time breaths in sequence with compressions): Aim for a ventilation rate of 6-10 breaths per minute**
- Simultaneous delivery of breaths *and* compressions may adversely affect coronary perfusion, and "has been associated with decreased survival" (ARC guideline 11.1.1).
- A common error was noted to be excessive ventilation rates. Increasing the ventilation rate may increase intrathoracic pressure, decreasing coronary perfusion pressure. (ARC guideline 11.1.1). Also, "As with no cardiac output, in situations of limited cardiac output the requirements for ventilation will also be reduced" (ARC guideline 11.1.1)

References and Further Reading

- Australian Resuscitation Council Basic and Advanced Life Support Algorithms

Acknowledgements

C4 Topic expert author: Sandra Cheng

C4 Simulation session author: Sandra Cheng

Cardiac Module Expert Working Party and Peer Review Team
Michael Bastick FACEM Gosford Hospital
Sandra Cheng Simulation Fellow SCSSC
John Kennedy FACEM Royal North Shore Hospital
Marian Lee FACEM Prince of Wales Hospital
John McKenzie FACEM Australian Institute for Clinical Education (AICE)
Clare Richmond FACEM Royal Prince Alfred Hospital
Morgan Sherwood Simulation Fellow SCSSC
Timothy Tan Simulation Fellow SCSSC
John Vassiliadis FACEM Royal North Shore Hospital

Educational consultants:
Stephanie O'Regan Nurse Educator SCSSC
Leonie Watterson Director Simulation Division SCSSC
John Vassiliadis Deputy Director SCSSC
Clare Richmond FACEM Royal Prince Alfred Hospital
Morgan Sherwood Simulation Fellow SCSSC

Disclaimer

Care has been taken to confirm the accuracy of the information presented and to describe generally accepted practices. However the authors, editor and publisher are not responsible for errors or omissions or for any consequences from the application of the information in this presentation and make no warranty, express or implied, with respect to the contents of the presentation.