

Advanced Life Support Update

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The International Liaison Committee on Resuscitation (ILCOR) was formed in 1993 and it has identified the following mission: 'to identify and review international science and information relevant to cardiopulmonary resuscitation (CPR) and emergency cardiovascular care (ECC) and to offer consensus on treatment recommendations'.

Representatives from the American Heart Association (AHA), the European Resuscitation Council (ERC), the Heart and Stroke Foundation of Canada, the Australian and New Zealand Committee on Resuscitation (ANZCOR), the Resuscitation Council of Southern Africa, the Inter-American Heart Foundation, and the Resuscitation Council of Asia currently sit on ILCOR.

The first ILCOR conference was held in 1999 and initial guidelines produced in 2000, with subsequent re-evaluation on a 5 yearly cycle. The most recent meeting was held in Dallas in February 2015 with Consensus on Science and Treatment Recommendations (CoSTR) statements produced in October 2015.

The following areas in ALS were reviewed as part of the 2015 review process:

Defibrillation Strategies for Ventricular Fibrillation (VF) or Pulseless Ventricular Tachycardia (pVT)

- Biphasic waveform (ALS 470)
- Pulsed biphasic waveform (ALS 470)
- First-shock energy (ALS 470)
- Single shock versus stacked shocks (ALS 470)
- Fixed versus escalating defibrillation energy levels (ALS 470)
- Recurrent VF (ALS 470)

Airway, Oxygenation, and Ventilation

- Oxygen dose during CPR (ALS 889)
- Basic versus advanced airway (ALS 783)
- Supraglottic airways (SGAs) versus tracheal intubation (ALS 714)
- Confirmation of correct tracheal tube placement (ALS 469)
- Ventilation rate during continuous chest compressions (ALS 808)

Circulatory Support During CPR

- Impedance threshold device (ITD) (ALS 579)
- Mechanical CPR devices (ALS 782)
- Extracorporeal CPR (ECPR) versus manual or mechanical CPR (ALS 723)

Physiological Monitoring During CPR

- End-tidal carbon dioxide (ETCO₂) to predict outcome of cardiac arrest (ALS 459)
- Monitoring physiological parameters during CPR (ALS 656)
- Ultrasound during CPR (ALS 658)

Drugs During CPR

- Epinephrine versus placebo (ALS 788)
- Epinephrine versus vasopressin (ALS 659)
- Epinephrine versus vasopressin in combination with epinephrine (ALS 789)
- Standard-dose epinephrine (SDE) versus high-dose epinephrine (HDE) (ALS 778)
- Timing of administration of epinephrine (ALS 784)
- Steroids for cardiac arrest (ALS 433)
- Antiarrhythmic drugs for cardiac arrest (ALS 428)

Cardiac Arrest in Special Circumstances

- Cardiac arrest during pregnancy (ALS 436)
- Lipid therapy for cardiac arrest (ALS 834)
- Opioid toxicity (ALS 441)
- Cardiac arrest associated with pulmonary embolism (PE) (ALS 435)
- Cardiac arrest during coronary catheterization (ALS 479)

Post resuscitation Care

- Oxygen dose after return of spontaneous circulation (ROSC) in adults (ALS 448)
- Post resuscitation ventilation strategy (ALS 571)
- Post resuscitation hemodynamic support (ALS 570)
- Post resuscitation antiarrhythmic drugs (ALS 493)
- Targeted temperature management (ALS 790)
- Timing of induced hypothermia (ALS 802)
- Prevention of fever after cardiac arrest (ALS 879)
- Post resuscitation seizure prophylaxis (ALS 431)
- Seizure treatment (ALS 868)
- Glucose control after resuscitation (ALS 580)
- Prognostication in comatose patients treated with hypothermic targeted temperature management (TTM) (ALS 450)
- Prognostication in the absence of TTM (ALS 713)
- Organ donation (ALS 449)

Each area had a PICO (population, intervention, comparator, outcome) question generated with identification and prioritisation of the outcomes to be reported. For example, for Antiarrhythmic drugs for cardiac arrest, the PICO question is:

'Among adults who are in cardiac arrest in any setting (P), does administration of antiarrhythmic drugs (e.g., amiodarone, lidocaine, other) (I), compared with not using antiarrhythmic drugs (no drug or placebo) (C), change survival with favorable neurologic/functional outcome at discharge, 30 days, 60 days, 180 days, and/or 1 year; survival only at discharge, 30 days, 60 days, 180 days, and/or 1 year; ROSC (O)?'

Following this there was literature review, written summary of the evidence for each outcome and development of the Consensus on Science statement. Whenever possible, consensus-based treatment recommendations were then created. The number in brackets represents the unique PICO identifier.

The quality of evidence available in relation to CPR and ECC is low to very low, really only allowing for weak recommendations based on evidence. However, there will still be some strong recommendations in the guidelines, especially where consensus opinion was that not following the recommendation could potentially result in harm.

These CoSTR statements are then used by ILCOR member organisations to update their national resuscitation guidelines, taking into account local factors, but with a commitment to minimise international differences in resuscitation practice. The Australian and New Zealand Committee for Resuscitation (ANZCOR) released their updated guidelines in January of 2016, with 47 updated guidelines out of their 75.

So what is new in our guidelines? The good news is that there are no major changes, and relatively few minor ones, so very little impact on current ALS practice. The majority of new recommendations in ALS relate to the post resuscitation phase of care. So this will be a recap of ALS with emphasis on the minor changes.

Basic life support



Just a brief mention of the BLS algorithm. The importance of early access and cardiac arrest prevention again highlighted, with early, high quality CPR. There is recognition of the emergency dispatcher coordinating the activity of bystander CPR whilst awaiting the arrival of the ambulance to facilitate early intervention. Of course, early defibrillation is a priority, with survival rates for out of hospital cardiac arrest (OHCA) of up to 50-70% if defibrillation is achieved in 3-5 mins.

Still using the DRS ABCD approach. CPR in a 30:2 ratio, compressions at 100-120 per minute (so an increase on previous recommendations), depth 1/3 of chest depth, duty cycle of 50%. ILCOR recommends at least 5cm, but not more than 6cm depth of chest compression. ANZCOR feel that it is impossible to tell the difference between 5 and 6cm and that too shallow a compression is more of an issue than too deep. They have not specified an upper limit for compression depth for this reason.

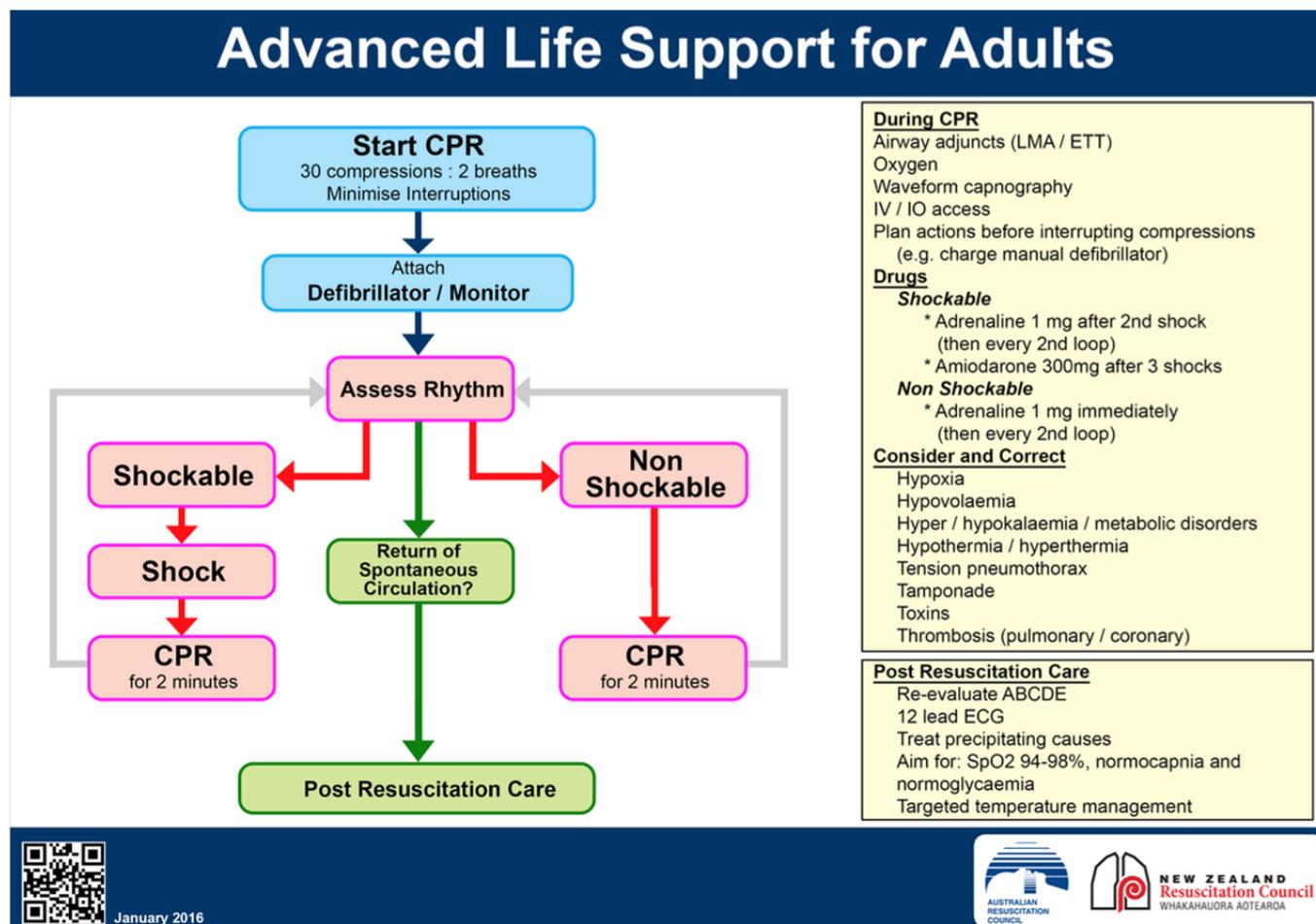
Compression only CPR if unwilling/unable to do mouth-to-mouth ventilation, results in better outcomes than no CPR. If doing ventilation, do not interrupt compressions for more than 10 seconds for breaths.

In an unwitnessed arrest, commencing compressions and allowing a short period of compressions whilst awaiting defibrillation may enhance the chance of successful defibrillation. In practice, the algorithm ensures this happens, with its focus on commencing compressions early, whilst awaiting arrival of the defib/AED/emergency services. ANZCOR recommends defibrillation as soon as the pads are attached if it is a shockable rhythm.

Public access programs and availability of AEDs essential if we are to improve outcomes from OHCA.

Advanced Life Support

There is a continued emphasis on recognition of the sick and deteriorating patient, with use of early warning systems and patient at risk teams recommended, to identify inpatients who are a risk of degenerating into cardiac arrest and implementing treatment before this occurs (or deciding resuscitation is not indicated).



The 2015 areas of review were (*bold italic are changes*):

1. Defibrillation strategies for pulseless VT and VF

- a. No major developments since 2010.
- b. The precordial thump may be considered for patients with monitored, pulseless ventricular tachycardia if a defibrillator is not immediately available (but evidence for success of this is weak and this should not delay defibrillation).
- c. All new machines deliver a shock using a biphasic waveform and the recommendation remains to use a defibrillator with a biphasic waveform (truncated exponential (BTE) or rectilinear biphasic (RLB) waveforms) where possible.
- d. ILCOR suggests an initial biphasic shock energy of 150J or greater for BTE waveforms, 120J or greater for RLB waveforms and 360 J if monophasic (although no longer manufactured, still in use in some places). ANZCOR have kept it simple, recommending 200J as the default for any biphasic machine, irrespective of waveform, with the caveat that other energy levels may be used providing there is relevant clinical data for a specific defibrillator that suggests that an alternative energy level provides adequate shock success (e.g. Usually greater than 90%).
- e. ***If the 1st shock is not successful and you are not at the maximum energy of the defibrillator, then you can increase the energy level for the next shock.***
- f. Single shock recommended rather than a stack of 3
 - i. A sequence of up to 3 stacked shocks can be considered in patients with a perfusing rhythm who develop a shockable rhythm where the setting is:
 - 1. a witnessed and monitored setting and
 - 2. the defibrillator is immediately available (e.g. first shock able to be delivered within 20 seconds and
 - 3. the time required for rhythm recognition and for recharging the defibrillator is short (i.e. <10 seconds).
- g. Pads better than paddles
 - i. Decreases the amount of hands off time as pads can be charged during CPR and reduces risk of arcing if paddles elevated from the chest.
 - ii. 8cm away from any PPM ideally
- h. Hands off time for defibrillation should be < 5 seconds.

2. Airway, oxygenation and ventilation

- a. Concern around the routine use of oxygen has been expressed.
- b. 100% FiO₂ should be used during CPR, titrated to saturations in the post resuscitation phase.
- c. ***The evidence (weak, observational studies) do not suggest superiority of an advanced airway technique over BMV, or for a SGA vs ETT.*** These studies have many limitations and bias and so there is no recommendation to change current practice. Intervention should be based on a stepwise approach, taking into account patient factors and airway operator skill level.
- d. ***Waveform capnography recommended to confirm ETT position both initially and ongoing during CPR.***

3. Circulatory support during CPR

- a. No evidence that CPR feedback devices improve outcomes in cardiac arrest, but may be useful in training to improve technique.
- b. ***Impedance threshold devices not recommended.***
- c. ***Automated compression devices not recommended*** unless unable to perform high quality CPR, or this puts the rescuer at risk. For example, CPR during cath lab procedures, where this will put the rescuer at risk of radiation exposure.
- d. ***Extracorporeal CPR is indicated in selected patients*** when standard ALS has failed (for example arrest in the cath lab), but this is not readily available in most centres in NZ.

4. Physiological monitoring

- a. ***Recommend waveform capnography***
 - i. Where this is not available other means of detecting CO₂/oesophageal intubation.

- ii. Recommend against using ETCO₂ values as a predictor of mortality and therefore to aid decision to stop the resus.

b. Cardiac USS

- i. Recommend use to rule out potential reversible cause of the arrest.
- ii. Must not interfere with standard ALS (for e.g. do not stop compressions to perform scan).

5. Drugs

- a. Standard dose adrenaline recommended (1mg)
 - i. There is evidence of benefit in short term outcomes (ROSC and admission to hospital).
 - ii. Unclear in terms of longer term outcomes e.g. survival to discharge and neurological outcomes.
- b. Amiodarone 300mg in VF or pVT recommended
 - i. improves ROSC rates, again unclear if any longer term benefit.
- c. Adding Vasopressin to adrenaline is not recommended. However, in places where vasopressin is already being used in place of adrenaline this may continue.
- d. Other drugs, including calcium, lignocaine, magnesium, potassium, sodium bicarbonate (and other buffers) may be considered to help manage particular conditions that are associated with patients who have arrested, but routine use not recommended.
- e. Fibrinolytics should not be used routinely in cardiac arrest, but may be considered when pulmonary embolus is the suspected/known cause of cardiac arrest.
- f. Data on the drugs used in ALS is very limited, with no real evidence that any drug administration improves long term survival, but no changes are recommended to current practice until there is high quality evidence on long term outcomes.

6. Cardiac arrest in special circumstances and special populations

- a. ILCOR ALS Task Force prioritised 5 topics for review in 2015:
 - i. Cardiac arrest during pregnancy
 - 1. Uterine displacement
 - 2. Early ALS and delivery
 - 3. Limited evidence for any interventions in obstetric arrest but still a strong recommendation
 - ii. Lipid therapy for cardiac arrest associated with overdose
 - 1. Routine lipid emulsion use in LA toxicity, TCA OD and other
 - 2. No evidence available so unable to make any recommendations based on evidence, but ILCOR dose then say 'despite the paucity of data, we do not wish to discourage the use of an antidote with some theoretical basis in a dire clinical situation'
 - iii. Opioid toxicity
 - 1. Use naloxone in opioid induced resp arrest with standard ALS for cardiac arrest
 - iv. Cardiac arrest caused by PE
 - 1. Thrombolysis may be indicated (and prolonged CPR)
 - v. Cardiac arrest during coronary catheterization
 - 1. If pVT or VF give 3 stacked shocks immediately prior to starting compressions
 - 2. Mechanical compression device may be appropriate to reduce radiation exposure to staff
 - 3. Extracorporeal CPR may be indicated
- b. Other special circumstances include, but are not limited to:
 - i. Avalanches
 - 1. Criteria to reduce futile extracorporeal life support
 - ii. Arrest post-sternotomy and cardiac surgery
 - 1. Chest reopening

2. Early defib even more of a priority to reduce compression time and risk of cardiac injury. Stack of 3 shocks considered if defib immediately available and can give first shock in 20s
- iii. Anaphylaxis
 1. Peri arrest algorithm
 2. Routine ALS and adrenaline once in cardiac arrest
 3. Large volumes of fluids may be needed
- iv. Asthma
 1. Arrest in Asthma linked to
 - a. severe bronchospasm and mucous plugging leading to asphyxia
 - b. cardiac arrhythmias due to hypoxia, stimulant drugs (e.g. β -adrenergic agonists, aminophylline) or electrolyte abnormalities
 - c. dynamic hyperinflation, i.e. auto-positive end-expiratory pressure (auto-PEEP), can occur in mechanically ventilated asthmatics
 - d. tension pneumothorax (often bilateral)
 2. Standard ALS with early ETT (disconnection of circuit may be needed, with chest squeeze, to relieve gas trapping and subsequent impairment of venous return)

7. Post resuscitation care

- a. **Avoid hypoxia and hyperoxia**
- b. Use highest FiO₂ during CPR until oxygen can be measured reliably post ROSC
- c. Maintain normocarbia
- d. Haemodynamic goals should be incorporated into any post resuscitation bundle of care
- e. **Targeted Temperature management (TTM)**
 - i. 32-36°C (previously 32-34°C)
 - ii. for 24 hours
 - iii. Recommended for:
 1. Out of hospital cardiac arrest (OHCA) with VF/VT as initial rhythm and remain unconscious after ROSC
 - iv. Suggested for:
 1. OHCA with unshockable rhythm and remain unconscious after ROSC
 2. In hospital cardiac arrest (IHCA) and unconscious after ROSC irrespective of initial rhythm
 - v. Recommend against prehospital cooling with cold IV fluids after ROSC
 - vi. Treat fever that develops after period of TTM
- f. Cath lab and PCI in those with OHCA and evidence of ischaemia (ST elevation or new LBBB), or no evidence of ischaemia but cardiac most likely cause even if remain comatose. Okay to proceed during TTM phase.
- g. Treat seizures appropriately, but routine seizure prophylaxis not recommended
- h. Standard glucose management protocols, treat if glucose > 10mmol/l
- i. ***In those treated with TTM, 72 hours post ROSC should be the earliest to start prognostication about outcome, and longer if any residual sedation/paralysis. Multiple modalities should be used.***
- j. If subsequent brain death occurs after arrest and ROSC, discussion of potential organ donation should occur

So, in summary, the changes in ANZCOR ALS guidelines produced in January 2016 following on from the 2015 ILCOR review are:

1. If the first shock is not successful and you are not at the maximum energy the machine can deliver, increase the energy.
2. There is equipoise between the basic and advanced airway techniques
3. Use of waveform capnography emphasised
4. Impedance threshold device not recommended
5. Automated compression devices not recommended

6. Cardiac ultrasound may be useful to rule out reversible causes
7. In the post resus phase
 - a. Avoid hypoxia or hyperoxia, maintain normocarbia
 - b. TTM recommendations, treat fever.
 - c. No routine seizure prophylaxis
 - d. Prognostication suggestions and organ donation

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