CPR: What’s changed? Are you doing it right?

Introduction

In 2010, the International Liaison Committee on Resuscitation (ILCOR) released its latest treatment recommendations on cardiopulmonary resuscitation (CPR).1 This was done as part of its five-yearly literature review cycle and was based on an examination and review of 277 resuscitation and emergency cardiovascular care topics. It is this consensus statement that is used as the basis for the creation of resuscitation guidelines by organisations such as the American Heart Association (AHA)2 and the European Resuscitation Council (ERC).3 These guidelines are then formalised into training courses such as the ERC's Basic Life Support (BLS), Advanced Life Support and European Paediatric Life Support; and the AHA's BLS, Advanced Cardiovascular Life Support and Paediatric Advanced Life Support courses.

What's changed?

There are four steps to the successful resuscitation of a cardiac arrest victim. These are recognition of the arrest, emergency response activation, the provision of high-quality CPR and rapid deliberation if required. Current changes to the CPR guidelines are a reflection of the most current resuscitation science, but are applied in such a manner that attempts to remove impediments to providing effective CPR. This has resulted in a significant simplification to the CPR process, as there is a focus on only those interventions that improve outcomes (cardiac compressions and early defibrillation), while discarding or de-emphasising those that have little or no evidence base, or add unnecessary complexity.

Basic life support and pre-hospital support

Untrained bystanders should provide chest compressions only to victims who are unresponsive and not breathing properly. Compressions should be hard (to a depth of 5 cm), at a rate of at least 100 per minute, and should allow full chest recoil with minimal interruptions. Those trained in CPR provision should follow a BLS algorithm initiating C-A-B (chest compressions, airway and breathing) by providing compressions first, and then ventilations at a compression-ventilation ratio of 30:2.1-3 This change from A-B-C (airway, breathing, chest compressions) to C-A-B is the most significant and most publicised change to CPR. It has been implemented to focus attention away from airway management and ventilation and toward the central role of chest compression, while reducing the time before chest compressions are started. In addition “look, listen and feel for breathing” has been removed from the AHA BLS algorithm,4 while the pulse check has been removed from the ERC BLS algorithm.3 Timeous activation of the emergency response system and use of an automatic external defibrillator (AED) is emphasised. All these changes have been implemented to reduce the algorithm complexity with the aim of getting more compressions done faster, and with fewer interruptions.

The next vital aspect is the early provision of defibrillation in patients with shockable collapse rhythms, or pulseless ventricular tachycardia or ventricular fibrillation. If a shockable rhythm is identified, a shock must be delivered immediately, minimising interruption of chest compressions, and CPR should resume immediately for two minutes.
before the second rhythm check. The use of a team approach to CPR results in minimisation of interruptions and improved CPR efficiency. The guidelines note that use of cardioversion and defibrillation with biphasic waveforms is more effective than with monophasic waveforms. Further details regarding the use of electrical therapies are provided elsewhere in this issue.

**Advanced adult life support**

Advanced adult life support builds on the principles of BLS and includes aspects such as airway management, ventilation support and arrhythmia management. Capnography has been emphasised to be of particular value in the management of cardiac arrest patients. It allows the confirmation of successful intubation; provides ongoing confirmation of intratracheal tube position; provides a means by which the effectiveness of chest compressions can be assessed (target an end tidal CO₂ of > 10 mmHg); may identify the return of spontaneous circulation (ROSC) (abrupt sustained increase in end tidal CO₂ of > 40 mmHg); and following ROS, enables ventilation titration, thereby avoiding the complications of over-ventilation. In short, capnography is a step toward tailoring resuscitation toward the needs of the individual.

If a shockable rhythm is still present after the first shock and two minutes of CPR, a second shock is given together with adrenaline (1 mg) every 3-5 minutes. An advanced airway can be placed and monitoring with capnography started. On the third cycle of CPR, amiodarone (300 mg bolus) is recommended. Reversible causes such as hypovolaemia, hypoxia, hydrogen ions (acidosis), hypokalaemia, hypothermia, tension pneumothorax, tamponade (cardiac), toxins and thrombosis (both coronary and pulmonary) should be identified and treated.

Atropine is no longer recommended in victims with PEA/asystole, although it still plays a vital role in the management of vagally mediated bradyarrhythmias. Chronotropic drug infusions of dopamine or adrenaline are now suggested as suitable alternatives to pacing for the treatment of the adult with symptomatic unstable bradyarrhythmia. In adults with symptomatic unstable tachyarrhythmias, treatment by synchronised cardioversion, or with adenosine if the arrhythmia is regular and narrow complex, is recommended. Where patients are stable, their management is determined by the width of the QRS complex. A wide QRS complex (≥ 0.12 seconds) can be treated by adenosine (if regular rhythm), beta blockers or calcium channel-blockers.

The inclusion of a post-cardiac arrest care module to patients who undergo ROSC is an exciting addition to the guidelines. The treatment is based on the optimisation of cardiopulmonary function, neurological monitoring and support, postoperative hypothermia, and identification and treatment of the precipitation of the arrest. Post-cardiac arrest care is discussed in further detail elsewhere in this issue.

**Advanced paediatric life support**

Paediatric arrests are predominantly caused by progressive respiratory failure or shock. Any CPR is better than no CPR and untrained bystanders should be encouraged to provide chest compression-only CPR, although, where possible, rescue breaths should be provided, as this results in more favourable neurological outcomes than compression CPR alone.

It is in the paediatric arrest population that the differences in interpretation of the ILCOR guidelines are most prominent. The AHA recommends retaining the C-A-B sequence in a paediatric arrest. They argue that it is unknown if the sequence in which CPR is provided makes any difference to outcome; that following the C-A-B approach should result in a delay of 18 seconds at most; and that the delivery of a simple consistent message will simplify training and increase bystander provision of CPR. In contrast, the ERC recommends modifying adult BLS by performing five rescue breaths followed by one minute of CPR, thus reverting back to the A-B-C approach in the paediatric patient.

While de-emphasised, the AHA has retained a pulse check in the algorithm, while the ERC has removed it. Chest compression in children (one year of age to puberty) should be to a depth of at least 5 cm, and 4 cm in infants (< 1 year of age), and defibrillation should be done with 2-4 J/kg (AHA) or 4 J/kg (ERC). The use of cuffed endotracheal tubes (ETT) may be preferred in victims with a high airway resistance, poor lung compliance, or with a threatened airway. For children between one and two years of age, a cuffed ETT with an internal diameter of 3.5 mm is recommended, while the use of the formula: cuffed ETT internal diameter (mm) = 3.5 + (age/4) is recommended after the age of two years.

**Are you doing it right?**

The short answer to this question is: probably not.
As has been shown in this paper, CPR has undergone significant changes; from four compressions with one breath and three stacked shocks in 2000, to 30 compressions with two breaths and a single shock in 2005, and now to the 2010 changes. Secondly, it has been repeatedly shown that both theoretical knowledge and practical skill undergo significant deterioration within weeks after being taught a CPR course. Of interest is that the loss of practical skill occurs faster than the erosion of theory, so even if you think you know how to do CPR, if you have not practised or had a recent update, you are not going to be doing it right. It’s time to update your CPR skills!

Thirdly, it must be kept in mind that “right” depends on who’s asking. As has been shown, the translation of the 2010 consensus ILCOR guidelines has resulted in variations on how CPR is being taught and it is important to appreciate this point. Providers, training institutions, accreditation boards and hospital administrators should take note that different training courses may hold equivalent validity.

Conclusion

The current 2010 CPR guidelines have been updated to reflect the newest resuscitation science, while at the same time attempting to simplify its practice. It is incumbent on us to effectively apply this theoretical knowledge to our patients and deliver improvements in clinical care and outcomes. The landmark change to C-A-B has emphasised the central role of compression and defibrillation in effective CPR, push hard and push fast. Hopefully these changes will permeate into society, resulting in more bystander CPR. In order for communities to become aware of the need for high-quality compression, all that is needed now is for the doctors on Grey’s Anatomy and Private Practise to start doing fast hard compressions, instead of intermittently leaning on the patient’s chest while shouting: “Breathe, damn it breathe!”

Conflict of interest statement

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References