Highlights of the 2005 Emergency Cardiac Care Guidelines: What are the major changes and why were they made?

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Abstract:

On November 2005 new guidelines for emergency cardiac care were published by the American Heart Association (AHA) and the International Liaison Committee on Resuscitation (ILCOR). This review will consider the new changes, look at the findings which justified some of them and show the lack of good scientific data to support some of the recommendations. Possible future directions will be also be looked at.

MeSH Words: Guidelines, ILCOR, cardiac care, resucisitation, ACLS

Introduction

On November 2005 new guidelines for emergency cardiac care were published by the American Heart Association (AHA) and the International Liaison Committee on Resuscitation (ILCOR) (1). These guidelines were published in a supplement of the journal "Circulation" and in the journal "Resuscitation". This publication was preceded by a review of studies performed since the previous recommendation and drafted trhough multiple consensus panels. In addition to the need to update the recommendations by taking into account recent findings, the panels also aimed to simplify the recommendations. These are the first major changes since the publication of "Guidelines 2000" (2). This review will consider the new changes, look at the findings which justified some of them and show the lack of good scientific data to support some of the recommendations. Possible future directions will be also be looked at.

Basic life support

The importance of good basic CPR has been one of the main focuses of the AHA and of the courses developed by the AHA (Advanced Cardiac Life Support (ACLS) and Pediatric Advanced Life Support (PALS) ever since their initiation (3). Studies have shown that the two significant interventions that improve survival rates in adult sudden cardiac death (SCA) are early defibrillation and basic CPR (4). The relative importance of uninterrupted chest compressions in adult SCA was already evident with the publication of guidelines 2000. The importance of uninterrupted chest compressions, even at the expense reducing the number of ventilation provided is based on a number of studies (5, 6). It has also been shown that the initial chest compressions in each cycle produce less blood flow than that achieved later in the chest compression sequence. In animal studies, interruptions in chest compressions were found to be associated with reduced survival rates (6, 7). Guidelines 2000 already advocated a change of the ratio of chest compressions to ventilation for 2 or more rescuers from 5:1 to 15:2. The rationale behind this change was to increase the number of uninterrupted chest compressions. Guidelines 2005 went a step further recommending a ratio of 30:2 for adult CPR (until the placement of an advanced airway device). Regarding the optimal rate and depth of ventilation during CPR, multiple studies have shown that healthcare providers tend to hyper-ventilate and that by doing so they may hamper the success of the resuscitation (8). Current recommendations for adult SCA are to ventilate at a rate of approximately 4-6 ventilations per minute (2 ventilation multiplied by 2-3 sets of 30:2 compression-ventilation cycles) prior to the placement of an advanced AW device. Following placement of an advanced AW device the recommended ventilation rate is 8-10 per minute. Decreasing the number of ventilations during adult CPR allows an increase in the number and continuity of chest compressions. Additionally the need and efficacy of additional ventilatory support is questioned by the following findings: 1. In the first minutes of VF, SCA blood oxygen levels remain high due to the diminished blood flow (6). 2. During CPR blood flow to the lungs is substantially reduced allowing for the maintenance of adequate ventilation-perfusion ratios with lower respiratory rates. (9).

In children and infants (but not in newborns) the recommended ratio of chest compressions and ventilations are 30:2 for a lone rescuer and 15:2 if two or more rescuers are available. The higher rate of ventilation when two or more rescuers are present is driven by the fact that in this patient population cardiac arrest secondary to asphyxia is much more common. In newborns the recommended 3:1 ratio of chest compressions and ventilations remains unchanged.

Adult advanced life support

Many of the changes in advanced life support are derived from the same effort to maximize the number and continuity of chest compressions that prompted many of the changes in BLS. Additional developments prompting the changes were: 1. the higher success rate of the new bi-phasic defibrillators (20-25). 2. The fact that following the successful defibrillation of a VF rhythm many patients do not achieve adequate cardiac output in the initial minutes. In Guidelines 2005 the previous recommendation for a sequence of 3 shocks for VF/pulseless VT has been cancelled. Instead a single shock is recommended, thus minimizing the interruption of chest compressions, which are assessed to be of greater importance to optimizing survival. Recommended level of energy for defibrillation varies between monophasic and biphasic defibrillators. In monophasic defibrillators the initial and subsequent doses should be of 360J.In biphasic defibrillators the recommended energy level is that recommended by its manufacturer. If the manufacturer's recommendation is unknown, providers should use 200J for the initial as well as subsequent defibrillations. These recommendations regarding optimal energy levels are somewhat arbitrary due to the lack of scientific proof to support one defibrillation wave over another or definite optimal defibrillation energy levels. Providers are also asked to consider providing 5 cycles of compressions-ventilation to patients with un-witnessed VF arrest or to patients who have been in arrest for 4 minutes or more without CPR. The aim of this recommendation is to improve the likelihood of successful conversion of the VF to a pulse generating rhythm by providing coronary perfusion and necessary substrates to the myocardial cells (10). Following defibrillation, providers are no longer prompted to assess rhythm on the monitor; instead they are to continue 5 cycles of ventilations-compressions

and only then assess the rhythm. The rationale for this new instruction is again the need to minimize interruptions in the delivery of chest compressions combined with the facts that even after a successful defibrillation initial cardiac output is usually decreased, and the lack of a proven risk for recurrence of VF caused by the chest compressions (11). InVF/ pulseless VT medications play a secondary role. There is a paucity of evidence to show that epinephrine (despite its almost universal use in resuscitation) improves survival in humans. Nonetheless epinephrine therapy is still recommended in the 2005 guidelines after 1-2 unsuccessful defibrillation attempts. Drug provision in all forms should not require interruption of CPR. Regarding the use of anti-arrhythmics in VF / pulseless VT the data supporting their efficacy is limited as well. Amiodarone remains the preferred anti-arrhythmic with lidocaine as an alternative

Pediatric advanced life support

In infants and children, as in the adult arrest patient, there is an emphasis on good basic life support. The new guidelines caution that when intubations are attempted by providers inexperienced with pediatric intubations they carry a high risk of complications (12, 13). The guidelines suggest that the inexperienced provider use bag-mask ventilation instead. The option of providing drug therapy via the endotrachial tube to the arrest victim is to be used only when attempts to achieve an IV or IO access have failed. Blood drug levels following endotracheal administration have been found to be significantly lower then when the IV /IO route is used (14) (this is true for the adult patient as well). The de-legitimation of high dose epinephrine goes one step further due to lack of efficacy and harm potential (15). High dose epinephrine for pediatric arrest was the recommended strategy before the 2000 guidelines. The latter recommended that following an initial dose of 0.01 mg/kg higher doses by any intravascular route may be considered. The new guidelines state that standard dose epinephrine is to be used in all cases except for exceptional circumstances such as β-blocker overdose.

Unanswered questions and future directions

Despite ongoing research, many questions remain unanswered in the matter of optimal strategies to maximize success of adult and pediatric resuscitation. These include even basic questions such as the optimal number of chest compressions, the optimal timing of advanced AW placement and drug therapy. Moreover the best methods of implementing proven strategies such as the induction of post-resuscitation hypothermia, which has shown promise in improving neurological outcomes, are yet to be charted. The most important message of the new guidelines is the unquestionable importance of early, effective and uninterrupted chest compressions for the arrest victim. Ways to improve the number of arrest victims receiving early and effective BLS and early defibrillation is probably the most important goal for the coming years. Additional research is directed at finding therapies to achieve better neuro-protection.

References

1. International Liaison Committee on Resuscitation. 2005 International Consensus on Cardiopulmonary Resuscitation and Emergency Cardiovascular Care Science With Treatment Recommendations. Circulation. 2005;112:III-1–III-136.

2. American Heart Association in collaboration with International Liaison Committee on Resuscitation. Guidelines 2000 for Cardiopulmonary Resuscitation and Emergency Cardiovascular Care. Circulation. 2000;102 (suppl):1–I384.

3. Standards for cardiopulmonary resuscitation (CPR) and emergency cardiac care (ECC) . 3. Advanced life support. JAMA. 1974;227: (suppl):852–60.

4. Valenzuela TD RD, Cretin S, Spaite DW, Larsen MP. Estimating effectiveness of cardiac arrest interventions: a logistic regression survival model. Circulation. 1997;96:3308–13.

5. Berg RA SA, Kern KB, Hilwig RW, Heidenreich JW, Porter ME, Ewy GA. Adverse hemodynamic effects of interrupting chest compressions for rescue breathing during cardiopulmonary resuscitation for ventricular fibrillation cardiac arrest. Circulation. 2001;104:2465–70.

6. Kern KB HR, Berg RA, Sanders AB, Ewy GA. Importance of continuous chest compressions during cardiopulmonary resuscitation: improved outcome during a simulated single lay-rescuer scenario. Circulation. 2002;105:645–9.

7. Yu T WM, Tang W, Sun S, Klouche K, Povoas H, Bisera J. Adverse outcomes of interrupted precordial compression during automated defibrillation. Circulation. 2002;106:368–72.

8. Aufderheide TP SG, Pirrallo RG, Yannopoulos D, McKnite S, von Briesen C, Sparks CW, Conrad CJ, Provo TA, Lurie KG. Hyperventilation-induced hypotension during cardiopulmonary resuscitation. Circulation. 2004;109:1960–5.

9. Baskett P NJ, Parr M. Tidal volumes which are perceived to be adequate for resuscitation. Resuscitation. 1996;31:231–4.

10. Eftestol T WL, Sunde K, Steen PA. Effects of cardiopulmonary resuscitation on predictors of ventricular fibrillation defibrillation success during out-of-hospital cardiac arrest. Circulation. 2004;110:10–5.

11. Hess EP WR. Ventricular fibrillation is not provoked by chest compression during post-shock organized rhythms in out-of-hospital cardiac arrest. Resuscitation. 2005;66:7–11.

12. Brownstein DR QL, Orr R, Wentz KR, Copass MK. Paramedic intubation training in a pediatric operating room. Am J Emerg Med. 1992;10:418–20.

13. Sirbaugh PE PP, Shook JE, Kimball KT, Goldman MJ, Ward MA, Mann DM. A prospective, population-based study of the demographics, epidemiology, management, and outcome of out-of-hospital pediatric cardiopulmonary arrest. Ann Emerg Med. 1999;33:174–84.

14. Efrati O B-AR, Barak A, Modan-Moses D, Augarten A, Manisterski Y, Barzilay Z, Paret G. Endobronchial adrenaline: should it be reconsidered? Dose response and haemodynamic effect in dogs. Resuscitation. 2003;59:117–22.

15. Perondi M RA, Paiva E, Nadkarni V, Berg RA. A comparison of high-dose and standard-dose epinephrine in children with cardiac arrest. N Engl J Med. 2004;350:1722–30.

Competing Interests: None Declared
Funding: None

This manuscript has been peer reviewed.

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